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SPACE AND TIME.

I. SPACE.

FEW categories have aroused more controversy than has space. The reason for this divergence of opinion lies, in part, in its basic character; in part, in its various forms and implications. Let the reader ask himself whether he can conceive the physical world apart from space? Does he not even locate—vaguely enough it may be—even his own sensations and emotions? Again, how many perplexing problems cluster around space as a center! Is the world infinite in extent or finite? Is it infinitely divisible? Is space a receptacle in which things somehow exist, or is it simply a term for the peculiar order of things? What is the relation between space and time? Are they absolutely antithetical as Bergson holds? Or are they supplementary and in a way correspondent? Is space reducible to time as some empiricists have held? Has each of us a private space? And, if so, is there a common space? Is space an entity, or subsistent, as neo-realists maintain? It is evident that enough questions can be, and have been, asked about this category. It would be easy to find material to write a weighty tome upon this category alone.

The consequence of this varied approach is that the field has become very complex; and so the unwary thinker is apt to become confused as he attempts to find his way about in the heaped-up literature. Each specialist envisages the topic from his own angle, and, in trying to be thorough, succeeds in making a treatise. In such a situa-

tion, it requires some temerity to attempt to cover the philosophical essentials in a brief article. And yet this is our task. But we can pluck hope from the fact that process and result are in a way incommensurable. Just as years of experimentation can be condensed into a single formula, so years of reflection and persistent pushing-through of a point of view can find relatively brief expression.

Space is a strategic category. The physical realist is called upon to defend its validity and self-consistency against the attacks of idealists. Important as this task is, I do not think that it is very difficult. Mathematicians have of late aided the philosopher by their very able analysis of space as a subsistential content involving position, order and distance. The majority of neo-realists have followed them in this work. But the critical realist has the further task of appreciating space as a category concerned with the physical world. The physical world is not simply subsistential space, and yet it has a "form" to which the character of such space is applicable. Scientific knowledge about nature contains spatial order as a primary ingredient. Physical existents can be located with reference to one another.

When the critical realist thinks of space as a category, he does not mean that space is a physical reality. He means only that valid knowledge of physical reality contains elements which can be universalized under such headings as distance, position, size, etc. We shall treat the category of quantity as intimately bound up with space, while fully admitting that there are quantities which are intensive rather than extensive. Knowledge of the physical world, then, contains such judgments as *that* this thing is to the right of that, this thing is ninety million miles from the earth, *that* these things are measurable in terms of an arbitrary unit adopted as a standard. All this is preliminary knowledge, if you will, but it is none the less valid.

This defense of space as a valid category marks one of the essential differences between a realistic naturalism and all forms of spiritualism. The antipathy of spiritualism to space is well known. Leibniz, its first protagonist, attacked the objective validity of space and maintained that reality consists of spaceless points which are in themselves immanently evolving spirits. For Schopenhauer, also, space is phenomenal and has no objective validity. Reality is of the nature of will. This agreement is no accident, for we find in Bergson, likewise, a tendency to belittle space at the expense of duration in consciousness. Space is stated to be homogeneity and simultaneity, while the self reveals itself to intuition as an interpenetrating flow of qualities. Space is here a sort of *pièce de résistance,* and the exact status of space and matter is not very clear; yet it seems certain that for him the higher levels of reality are non-spatial.

With the general attitude of neo-realism toward science the critical realist is in the heartiest sympathy. Still, the profound difference in epistemology has its necessary consequences.

The neo-realist is nearer naive realism than is the critical realist, yet he champions the non-mental reality of such entities as space, time and number. When he includes values of all sorts, he is led to attack naturalism with the fervor of the Platonist.[1] Neo-realism and Platonism have much in common; critical realism and Platonism have little in common. Of course, values are real just as sentiments, desires and judgments are. But they are entirely human affairs.

Evolutionary naturalism is a critical naturalism. It distinguishes between objective contents in the individual's experience and the physical objects of his knowledge. Thus

[1] Cf. Spaulding, *The New Rationalism,* p. 498. (Why not a "new naturalism" as well as a "new rationalism"?)

critical naturalism can do as full justice to mathematics and logic as Kant and Locke tried to do. The weakness of the older naturalism was its unreadiness to do justice to the reality of mind, mental entities and values.

A Genetic Approach.—We shall find it true of space—as of the other categories—that it has different levels and contexts. Therefore, our first task must be the separation of these levels and a relation of them to their proper universe of discourse.

The more highly developed kinds of space, while not simply reducible to the more primitive types, cannot be understood apart from them. They are a development, a clarification, of them. The categories which we apply to the physical world have their birth in the field of perception. It is this point which I wish to emphasize by this genetic approach. Discrimination and reflection play their part, but they must have material on which to work. This material consists of sensible characters given in consciousness.

Sensational Space.—The philosopher does not feel it his task to trace the spatial experience of the adult to its beginnings. It is for the psychologist to discover the various factors whose active synthesis leads somehow to the perceptual level at which we all naturally live. Enough along this line of investigation has been done to convince the thinker that the process of fusion and development has been both a gradual and a progressive one. But the fact remains that we are not ordinarily aware of anything but the result. We live on the crest of the wave of experience and profit by all that has gone before; or, to vary the simile, we are like spectators in the theater who see the finished play and do not know what goes on behind the scenes. Assuredly, the adult's ability to distinguish position, distance and size is an accomplishment. "For those

who are born blind," writes Bourdon, "space is a synthesis of tactile, muscular and joint sensations, and particularly of the tactile, muscular and joint sensations of the fingers, of the hand, of the arm and of the lips; for the normal man, on the contrary, space is essentially a synthesis of retinal sensations with tactile, muscular and joint sensations of the eyes and of the head. Now a long time after sight has been given to one born blind, he will still keep his old way of representing space."[2]

Before passing to the level of normal perception as dominated by sight, touch and movement, it will be well for us to note certain data which are calculated to restrain us from dropping into the dead-level view of space which has so often appeared in philosophy and mathematics. Had Kant meditated on these facts, his theory of space could not have been so neat and simple. It is a well-known fact to-day that the spatial extensities primitive to different senses are not correspondent, that there is something of qualitative incommensurability about them. "The interior of one's mouth-cavity feels larger when explored by the tongue than when looked at. The crater of a newly extracted tooth, and the movements of a loose tooth in its socket feel quite monstrous. . . . If two points kept equidistant be drawn across the skin so as really to describe a pair of parallel lines, the lines will appear farther apart in some spots than in others."[3] Of course, very few of these and similar facts are noted in every-day life because the interest of the individual is not directed toward them. We live in a space which has gradually been standardized because of our need to adapt ourselves to our environment, physical and social.

Perceptual Space.—Perceptual space arises at a level in which the synthesis of the various sources has been

[2] Bourdon, *La perception visuelle de l'espace*, p. 362.
[3] James, *Psychology*, Vol. II, p. 139.

pushed a long way. The role played by meanings and cues is the evidence of this fact. Visual and tactile space have so intimately been brought together that we pass from one to the other without any sense of difference. The one has come to mean the other in our spatial interpretations of things and distances and positions. But the part played by movement in the growth of perceptual space, as a sort of continuum of things in which we experience ourselves as living, can hardly be overestimated. Motor experiences organize, suffuse and knit together interpretatively the material contributed by sight and sound. Our vital interests are always forcing us to note positions and to estimate distances and directions, sizes and contours. Space becomes an affair of discriminations and estimations within a realm of apparently given things.

Now the perceptual level is likewise the level of things, their qualities and relations; it is the stage of common-sense realism. As we should expect, perceptual space reflects this situation and appears in completest harmony with it. Things have size, shape, position; they are at certain distances and in certain directions from one another. Space is not a thing, rather is it the complex of these characters. The whole perceptual field arises together as both quality and structure. The older philosophers and psychologists used to speak of an act of objectification by means of which the self passed from sensations to things. A little reflection should convince us, however, that objectification is a growth and not an act. It represents the passage from the vague and inchoate to the relatively clear and structural. Sensations are not first experienced in the head — how could they be? — and then extruded in some mysterious fashion. Objectification is a functional growth rather than a unique act.

Perceptual space is, then, the spatial character of the field of the individual's experience. It is a character which

ministers to all the meanings of thinghood and independence. The book which I see in front of me is appreciated by me as at once self-existent, perdurable, composed of printed paper, of a certain size and shape, so far distant and in such a direction.

But this spatial realm of perceptual things has three main characteristics which each one can verify for himself, and which are of considerable philosophical interest. It is, first, limited in extent. Our horizon always has a boundary, and near objects are more distinct and better defined spatially than are far ones. In short, each one perceives a concrete manifold of objects which is limited on both sides and also in the third dimension. I can see only so far in front of me and am compelled to turn my head in order to see objects too much to one side. In the second place, perceptual space is sensibly continuous, or unbroken by that which is non-spatial. It is obviously impossible to escape the presence of space in perception for it suffuses and relates the content of the field. All things have position. What we perceive in vision is of one character so far as extensiveness is concerned. Spatial material is at the heart of it genetically. If the term be not misunderstood, space can be called a *form* of things, that is, an omnipresent character with which we can contrast other, more variable features like color and odor. Space is a constant character of the field, while other characters undergo successive change. These elements vary independently. A thing may change its color while not changing its place; and, again, it may change its place without changing its color.

Empiricism vs. Nativism.—Psychologists and philosophers were long divided upon the question of the comparative innateness of space-perception. This problem is more a psycho-biological than a philosophical question,

that is, it is a question of genesis rather than a question of content and validity. But I do not think that it is going too far to assert that the historical controversy between those who believed space to be an innate possession of the "mind" and those who sought to derive it from elements essentially non-spatial in character has ceased in large measure to be a real one. The original antithesis has been outgrown in these evolutionary days. The Kantian form of nativism, called by Stumpf the psychic-stimulus theory, asserts that space is an innate form of the "mind" in which the chaotic manifold of qualitative sensations is arranged. Kant assumes that form and qualitative content are derived from different sources. The Humean type of empiricism sought to derive space from the arrangement (?) of qualitative points.

Kant's schema has many obvious weaknesses: it has a view of the mind which we would hardly accept to-day, and assumes that all connectedness is contributed by the agency of a transcendental ego of apperception. As a matter of fact, relations appear to be as sensuous in the first place and as naturally given as any other features of the perceptual field. The Kantian machinery strikes the present thinker as extra-natural and uninforming; and Kant's formulation is, historically, an attempt to supplement Hume rather than to make a thoroughly new analysis.[4]

That all perception rests upon, and involves, processes of discrimination and interpretation is a commonplace of to-day, but it was not so in Kant's day. That much should be pointed out in apology for Kant's formal intellectualism. Where we see genetic process, Kant saw a formal operation. It was this formal operation which involved the coming together of two unlike mental factors, the *a priori* and the *a posteriori*, the one contributed by the mind in a

[4] Cf. *Critical Realism*, Ch. 6. William James and James Ward—among others—have subjected the Kantian psychology to severe criticism. I hardly feel that there is need to kill the already slain.

free way, the other caused by something outside of the mind. We cannot permit a nativism which assumes an *a priori* element of this sort. All elements are innate in the sense that they are functions of the brain-mind under stimulation. The following quotation is, I think, a fair statement of contemporaneous psychological opinion: "We hold that the crude, vague feeling of extension, of volume, is a genuinely innate experience, unlike any other experience, and underived by mere experience from non-spatial psychical elements. So far we are nativists. On the other hand, we are confident that all accurate knowledge of the meaning of the space relations in our space world, all practically precise perception of direction, position, contour, size, etc., is a result of experience, and could never be gained without it. So far we are empiricists, holding to a *genetic* point of view regarding the development of our adult space-consciousness."[5] The spatial character of the field of objects which we suppose ourselves to perceive is a discrimination gradually achieved through material lending itself to the distinctions.

The Truth of Perceptual Spatial Judgments.—We have already suggested that judgments usually imply the setting of common-sense realism. That is, the judging individual is convinced that he perceives self-existent things which are the sources and centers of such executive agency as finds place in his world. He, himself, is only one—though a unique case—of these manifold things. In veridical perception, he becomes aware of such things and passes judgment upon their characters and relations. His sense of things does not always appear in explicitly judgmental form, but it can easily be so analyzed; and the judgments resulting will be considered true. Thus this red book in front of me is oblong in shape, quite thick, medium octavo

[5] Angell, *Psychology*, p. 141.

in size, two feet from me and toward the right. These spatial predicates can be tested by renewed perception and then accepted as finally valid—their exactness being adequate to my purpose. What shall we say of them?

It is evident that, within this setting of realism, I assume that I can note these features, or characters, and can subsume them under conceptual characters which I possess. The book is of this size. That is, I can discriminate its size and identify it just as I discriminate its color and identify it. And so with the other predicates. There is, so far as I can see, nothing mysterious in this process as long as it is kept within its setting and continues to be empirical. We have simply that interpretative interplay of perception and conception which is the heart of judgment. Relative positions, sizes, contours, distances, are distinguished and interpreted by means of concepts already in our possession as a result of past experience. Such judgments are as true as any other judgments directed upon sensible things. That this book before me is oblong is just as true as that it is red; that it is to the left of my typewriter is as certain as that it is cloth-bound. Yet such judgments are the *material* of our critical knowledge about the physical world.

Conceptual Empirical Space.—One further development of our spatial experience, which is at the same time a development of our idea of the physical world, deserves notice. Perceptual space is dominated by a perspective. It is the sensuously given expanse of things that stretches out from the percipient organism. Now empirical space is a development of this space somewhat as perceptual space is a growth out of sensational space. Empirical space is a conceptual combination and modification of the various perceptual spaces into the thought of a continuous world spread out in every direction. The vague appre-

hension of this larger, more inclusive world spread out in every direction floats in the background of our consciousness to qualify what we perceive at any one time. Thus there is no break between perceptual and conceptual space. One point of interest is, however, that we assume that things we perceive are in relation with things we do not perceive but acknowledge to exist. Moreover, these things are taken to be common to all people. Commonness is a meaning which suffuses things and, therefore, the spatial form and relations of things.

We need hardly linger upon the genesis of empirical space. Movement from place to place, with the areas combined by thought, reading, intersubjective intercourse, etc., all these factors assist in our conception of the world as a spatial expanse in which positions, distances, contours, sizes, directions can be distinguished. Direction is now referred to the sun and the points of the compass rather than to the body of the percipient; size and distance to units of measurement upon which agreement has been reached. It follows that we have here only a development of perceptual space. The setting is essentially the same—a common world of things open to discriminative apprehension. Measurement and a useful axis of reference introduce the chief changes in the field of objects. Another point should, however, be noted: most of the physical expanse is absent so far as perception is concerned. It is chiefly present in thought though absent in reality. Let us remember that, for common sense, experience supervenes upon things which are self-existent. We perceive things which are present and think of things which are absent.

This spatial, physical world has no apparent limits. Astronomy tells its marvels of constellations beyond constellations in pathless space, and the imagination grows weary in continuing a process to which there seems no

necessary end. But it is important to note that space is still neither a thing nor a semi-reality, for it is inseparably intertwined with bodies. It is not a receptacle into which things are put but a distinguishable character of related things. The world is not so much in space as it is spatial or extended.

Science deepens our appreciation of the spatial character of bodies. Common sense, being limited to surface views, misses the knowledge which comes from the combination of cross-sections. Mechanics with its study of stresses and strains, physics with its appreciation of interdependence, chemistry with its theory of rings and stereoisomeric substances, biology with its discovery of structure, all deepen the spatial aspect of things. He who has studied the detailed structure of the nervous tracts can hardly deny the reality of position.

Mathematical Space.—But the observational and experimental sciences are not the only sources of our deepened knowledge of space. They are the only basis of actual knowledge of the spatial nature of particular objects, it is true, but they are assisted by an abstract science which studies spatial characters as such, viz., mathematics. It is this non-physical science which assists the physical sciences through the setting-up of a correspondence between their material. The position we shall adopt is, that mathematical space is an abstractive construction resting ultimately upon characters gotten in perception. Mathematics is an intense study of the nature of spatial relations. The information it acquires is, therefore, interpretative of physical relations. If a body is a sphere, the results deduced mathematically about a sphere are relevant to my thought of this body.

The empirical basis of the ultimate material of mathematics is indicated by the history of the subject. But this material is conceptualized and studied intensively and in the

light of all sorts of methods. Analytic geometry and calculus are examples of what I mean by this inventive, intensive study. The results are, however, applicable to the material to which they are instrumental. It is for this reason that calculus is as instrumental to the physical sciences as is geometry, which is far more directly related to perception. In other words, the material of physical science overlaps in part the material of mathematics. I agree, then, with James Ward in his criticism of Kant: "Given only the pure space of Kant and the geometers, it is impossible to deduce the actual space of experience; but, given this, the deduction of that is intelligible."

Now how does this construction arise? We have already seen it well under way in our examination of common, empirical space. We learn to abstract the spatial features of bodies. In this way is obtained the concept of an empty space homogeneous in all directions. There can be no doubt that this process of abstraction is aided by the fact that bodies change their places, that is, their relative positions, while retaining their forms. This experience of rigid bodies which move from place to place enables the mind to advance to the conception of space as such, to spatial characters as such. This genesis has left its trace upon the geometrical concept. Just because rigid bodies have dominated our experience, we tend to think of the parts of empty space as immovable and exclusive of one another. What we do is to remove thinghood and non-spatial characters from the empirical expanse of ordinary perception. It is for this reason that I affirmed that content is emphasized in mathematical space and reference omitted. Mathematics is a non-existential science; it is not a science directly concerned with the physical world, even though its information is valuable for the physical sciences.

There are to-day both metrical and non-metrical geometries. So soon as geometrical objects are thought of as

having size, we enter the domain of metrical geometry, which is decidedly the more primitive type. But how is it possible to measure the magnitude of a geometrical quantity? Primitively by superposition.[6] The geometrician must be able to distinguish the two elements of position and form; and he determines equality by such a relative displacement as results in coincidence. "The figures are equal," writes M. Poincaré, "when one is able to superpose them; in order to superpose them, it is necessary to displace one of them until it coincides with the other: but how can one displace it? If we ask this question, it will be replied without doubt that one ought to do it without deformation and *after the fashion of an invariable solid.*" It is from this situation that the geometrical axiom of free mobility arises: Spatial magnitudes can be displaced without deformation. Now this axiom bears witness to the origin of mathematical space.

But mathematics has recently passed through a stage of reflective analysis in which search has been made for the smallest number of axioms which could bear the weight of a rational construction of different mathematical systems. For all the elements and processes involved, definitions are sought. There is, however, no real conflict between this demand and the acknowledgment of the genetic origin of the construction which is thus being rationalized. Reflection clarifies, discriminates, abstracts, defines, and logically relates elements of content, but it has its cues and suggestions in the material which has first been intuited. Mathematical space is, in other words, a development of the characteristics of empirical space, such as order, direction, distance and area.

Perhaps the contrast between empirical space and mathematical space can best be brought out by an examination of the idea of space held by prominent mathematicians.

[6] Cf. G. Lechalas, *Etude sur l'espace et le temps*, p. 31.

This method of approach will also give us the basis for a better understanding of the ideality or non-existential status of mathematical space.

Newcomb defines space as the totality of all positions into which a body could possibly be moved, were no impediment to motion in existence. "This totality," he writes, "forms a continuum, the conception of which is so elementary and fundamental that no definition can materially aid in its formation. To us the parts of space are all those places, infinite in number, to which or in which a body can be conceived to move or exist, and *vice versa*, we can conceive any body to move into a part of the infinite continuum which is formed by the totality of those places. Space is continuous not only in the sense that every part joins to the parts around it, but that every part is susceptible of indefinite subdivision."[7] What I have said of the empirical source of mathematical space stands out clearly in every sentence of this article. Spatial characters are enriched by operations, potential and actual, to which there are no assignable limits. Let us now turn to Russell. In his *Scientific Method in Philosophy* he makes the following remarks: "I do not see any reason to suppose that the points and instants which mathematicians introduce in dealing with space and time are actual physically existing entities, but I do see reason to suppose that the continuity of actual space and time may be more or less analogous to mathematical continuity. The theory of mathematical continuity is an abstract, logical theory, not dependent for its validity upon any properties of actual space and time. What is claimed for it is that, when it is understood, certain characteristics of space and time, previously very hard to analyze, are found not to present any logical difficulty." Continuity and infinity are, then, logical concepts which are applicable to space and time as derived from

[7] Newcomb, art. on "Space," *Dictionary of Philosophy*.

experience and which enable us to analyze and handle these characters. In accordance with this logical effort, point, instant, continuum and infinite are assumed or defined. Continuity is a property of series, and a series is continuous when between any two terms whatever, however near, another one can be placed. Again, infinite numbers cannot be reached by counting: they are a class quite distinct from finite numbers and have properties peculiar to themselves. It should be noted what a part number-theory has played in the formation of these concepts.

Mathematical space is, then, continuous and infinite, and there is no self-contradiction in these concepts. But mathematical space is more a system of operations and elements than a given expanse. For instance, for mathematical purposes, any object may be taken as a point or position. Again, when a mathematician speaks of an infinite number of points between any two positions on a straight line, what does he mean? He means that this portion, like any other portion, is a continuum. In a continuum there is no *next* position but always one *between*, and so on indefinitely. Thus we achieve the conception of a compact series. To assert that a line is infinitely divisible is not to regard it as made up of self-existent entities which are discrete and distant but to indicate a process which has no limit. Positions are foci of a conceptualized attention. They are the homologues in abstract space of things in perceptual space. Positions imply other elements because they are inseparable from distance and direction. Or we may put the same conclusion in the following way: if points were spatial, they could be further divided; if they were spaceless, they could not make up a piece of line-room. Infinite divisibility is the expression of this relativity of position in the total character of space.

In his treatment of space, Bergson often seems to confuse this abstractive space of mathematics with something

purely external. He does not do justice to the subsistent status of mathematical space. Time, or duration, is internal and pure heterogeneity, while space is external and pure homogeneity. Besides, I do not think that many mathematicians would agree with him that number is inseparable from space.[8] These abrupt antitheses are not empirical; they are dialectical—just the sort of method that Bergson claims to avoid. Even abstract space is not mere simultaneity; it is position, direction and distance. And are not these elements qualitative characters? But we shall be obliged to reexamine Bergson's doctrines when we come to treat time.

It is also necessary to say a few words about the theory that space is reducible to time. This theory has taken two forms. First may be mentioned the older associationist stress upon the succession of sensations in the formation of tactual space. But they forgot that this succession was accompanied by the character of coexistence in the complex of sensations in the resting hand, and that this latter character dominated the interpretation of the total experience. Positionness and extensity are characters which function actively in the construction of space. An element in the process, such as the temporal succession of new experiences, can be used in the making of a product in which temporal succession is not an element.

The second form of the temporal theory of space asserts that space is but a reversible time-order. We can pass from *a* to *b*, *c* and *d* and then back again. Of course we can. Space permits the passage of our attention or of our overt action back and forth over things. But the temporal order is that of events; in this case, our acts. Action implies space and space lends itself to action. To reach a distant object, I must pass by intermediate objects. But

[8] I believe that it is generally held to-day that numbers are concepts. Cf. Shearman, *The Scope of Formal Logic*, Ch. 6.

this does not contradict the fact that these objects were, all the time, in the relation of coexistence in the order of side-by-sideness, the basis of direction. And, by the way, is not the very expression "a reversible time-order" a contradiction in terms? It is an attempt to combine the different qualitative orders of space and time. Our actions are reversible, but the time-order is not.

Space as a Category.—Having now gained a fair idea of the genetic basis of conceptual space and also some insight into its character as a subsistent content, we are ready to consider the validity and meaning of this content when used as a category of knowledge about the physical world. That world is for us reality, the very substance of being. And it is by an irresistible pressure of the material of knowledge that we think of it as extended. Some thinkers, it is true, hold that this pressure of our objective experience to consider reality spatial in its character, that is, to hold spatial predicates applicable to it, leads to a disastrous conflict between reason and instinct. But I think that even they must concede that the burden of proof rests upon them.[9]

Space claims, then, to be a cognitively objective category, to mediate knowledge about reality. Judgments of position, relative size, contour, distance and direction are, therefore, referable to the physical world. To say that these judgments are valid and contain information referable to an independent realm is to think this realm spatial, *for these elements give the very meaning of space as a category*. Space as a category is not a thing to be pictured. To assert that the physical world is spatial, means, not that the physical world is *in* a non-dynamic receptaculum analogous to mathematical space, but that certain predicates

[9] Cf. Bradley, *Appearance and Reality*, Ch. 4. For another reason, Bergson also attacks the validity of space as a category.

are interpretative of its actual constitution and nature. While we need not exaggerate the amount of information given by spatial judgments nor the depth of insight contributed by them, it is likewise unnecessary to deny their significance. The morphologist has his work to perform as well as the physiologist. An organism has structure as well as function. We shall learn, as we proceed, that the categories supplement one another and are intertwined in adequate knowledge.

An Historical Retrospect.—Science always acts as a stimulus to the active thinker, and he who does without this stimulus is apt to swing around in a dialectical circle, trusting all the time to the advent of some pictorial intuition. The first philosophical view of real space identified it with a void in which atoms somehow exist. This void, the μὴ ὄν of Greek philosophy, was a sort of semi-reality which could be filled and which could also remain empty. The fact to note about this outlook is its failure clearly to distinguish between mathematical space and the void. Physical reality is thought of as passively dispersed.

Plato identified matter and extension—just as Descartes did after him—and was led to reject the void of the atomists. But, here again, mathematical space tends to be reified. When Descartes asserts that the defining essence of matter is extension, he is in the hands of a mathematical rationalism which pretends to intuit reality rather than to gain an elementary knowledge applicable to it. He does not realize that mathematics is a non-existential science which can be developed for its own sake as well as be used as instrumental to the various physical sciences.

The development of mechanics gave rise to the Newtonian conception of nature which gave a semi-reality to space as such. For Newton, space is as a whole hyperphysical, an independent, fundamental variable in relation

to which the world directs itself. We are led to think of it as a connecting continuum in which things are. Thus its unity gives unity to the world of things in space. This means that the unity was not so much held to arise out of the nature of the physical world as out of this menstruum. It is only fair to Newton to point out that there have been different interpretations of his system, especially in regard to such a problem as action at a distance. Yet, when all is said, absolute space is for him a receptaculum. His system is impregnated with what may be called mathematical realism. Space as a category of our knowledge of the physical world is confused with the content of mathematics.

To make Newton's position somewhat clearer to the reader, let us glance at the teaching of a contemporary mathematician. In *The Problems of Philosophy* Mr. Bertrand Russell writes as follows: "Thus we may assume that there is a physical space in which physical objects have spatial relations corresponding to those which the corresponding sense-data have in our private spaces. It is this physical space which is dealt with in geometry and assumed in physics and astronomy." I interpret this position as similar to Newton's, although I must confess that Mr. Russell's philosophy is fundamentally unclear to me. What is this physical space? Is it the physical world conceived as spatial, that is, in terms of spatial predicates? Or is it a second kind of reality, a receptacle?

Faraday inaugurated another movement which may be regarded as a reaction against a conventionalized Newtonianism. His experiments led him to adopt the view that all physical action is mediated by intervening physical conditions. The physical world, in other words, has its own dynamic continuity and does not need to borrow it from a real, hyperphysical, absolute space. The whole drift of modern science has continued in this direction.

It is time that mathematical objects and content be separated from physical reality.

When I assert that a physical thing is extended, I mean that it is measurable in terms of units superposed directly or indirectly upon it, that it actively excludes other things, that its parts have a characteristic external order of position in relation to each other, and that these facts can be related to other facts which can be brought out by experiment. In this sense, I have the right to say that physical things are extended without meaning that they are in an absolute space as a sort of receptacle or that they possess an attribute of which I can gain an idea of a copy sort. Hence, to assert that nature is extended is to maintain that human knowledge about nature contains elements of a certain content. Physical space is, then, the physical world known as spatial. The more we know about the intimate structure of the physical world, the more we know about real space. So far as mathematics is of assistance to science, it does not come between nature and our knowledge as a disturbing factor, and the thinker must rid himself of the habit of assuming that physical things are in a homogeneous medium made of positions.

Kant's Antinomics.—Kant sought to prove that the assumption that reality is spatial lands us in certain contradictions which can be avoided if we once admit that space is phenomenal and holds only of phenomena. His argument has played such a role in the history of philosophy and is still taken so seriously that it must be examined.

Kant's thesis is, that the world is limited with regard to space, that is, that it has a determinate and finite size. His method is to point out the contradiction in the opposite assumption. "In that case," he asserts, "the world would be *given* as an infinite whole of coexisting things." But to the realist the expression "given" is ambiguous. Does

it mean "exist"? Either we can have a conception of an infinite totality of things (or had we better say, an infinite extent?), or we cannot. If we can, such an infinite totality *may* exist. If we cannot, there is no reason to assert what is meaningless to us. Now Kant seems to suppose that, in order to conceive an infinite world, a successive synthesis—presumably by human minds—would have to be looked upon as completed. But is this necessary? A standing infinite would rather be one which was thought of as inexhaustible by enumeration or measurement. For Kant, it is one which should, but cannot, be enumerated.

His antithesis is, that the world is infinite in respect to space. Here, again, he works by disproof of the contradictory. If the world be finite, it would exist in an empty space without limits. We should, therefore, have not only a relation of things *in* space, but also of things *to* space. But such a relation would be a relation to no object and therefore it is nothing. Hence, the world is not limited with regard to space, that is, it is infinite in extension.

Let us look at this strange argument. In the first place, it assumes that a finite world must exist in empty space. We, however, have shown that such a space does not exist, since it is the mere reification of an abstraction. Kant then argues that, because such an empty space cannot limit the physical world, this latter must be infinite. But this argument makes the assumption that what is not limited from outside is infinite—an unwarrantable assumption.[10]

We are forced to conclude that Kant disproves neither his thesis nor his antithesis. We are left, therefore, with a choice to be determined on other grounds. And Kant's purpose is defeated.

What must be our own conclusion in regard to this

[10] For the quotations from Kant see Müller's translation of the *Critique of Pure Reason*, pp. 344ff.

age-old question? We may put it in this fashion: If the terms, finite and infinite, are contradictory adjectives applicable to the physical world, no *a priori* reasoning can decide for one as against the other. Inductive science, alone, with its superstructure of tested theory is potentially able to decide the question, and the day has not come when this can be done with any certainty. I would, however, like to call attention to certain points sometimes misunderstood.

The principle of the conservation of energy does not by itself point in either direction. It simply maintains that energy is not lost or gained; it does not inform us how much energy there is in the universe. Again, the second law of thermo-dynamics, popularly known as the law of the dissipation of energy, sets a problem for the course of nature, but does not inform us whether nature avoids it by being infinite or by being able to reverse the process. The truth is that these principles are more intimately bound up with the category of time than with space.

If nature be finite and thus of a determinate size, as many facts seem to attest, this character does not necessitate it to have a smooth boundary beyond which electrons could not dash. The boundary needs must be dynamic and one of varying equilibrium. If gravitation have significance for the minutest portions of physical reality, its internal pull will determine the "flaming boundaries" of the world. The void is perfectly thinkable, for it is purely a condensed negative proposition and not a thing. It is nonsense to assert that the void *is*—if this expression be interpreted as an existential proposition. It really means that not one of the things we are accustomed to find is present. But, it will we demanded, can we not ask the question, What lies beyond? Certainly we can; and the void is the denial that anything lies beyond.

Is Nature Infinitely Divisible?—Mathematical space is infinitely divisible. But it does not follow that a physical thing is infinitely divisible. In the case of the one, we are concerned with an operation of thought correspondent with the nature of the material operated upon. In the case of the other, we are confronted with a problem of fact. Certainly, human beings cannot divide a physical thing into an infinite number of parts. The structure of things seems to be atomic. Of late, theories of energy have drifted in the same direction—as comes out clearly in the quantum-theory of Planck. Nature—to use James's expression—seems to bud off drop by drop. Infinite divisibility would seem to involve a passive sort of homogeneity; and this is alien to the dynamic, structural character of the world as revealed in experience. To substitute mathematical space and its characters for reality—however valuable instrumentally at times—is to beg the question.[11]

II. TIME.

The usual feeling in regard to time has been expressed by no one better than by Saint Augustine: *Quid est tempus? Si nemo ex me quaerat, scio; si quaerenti explicare velim, nescio.* No concept is more baffling and has more subtle apparent contradictions than has time. As one other writer has put it: "All things live in time and it lives in nothing; all things die in time and death is not able to attain it." But may it not be that it is this very mystical tendency to substantialize time that leads us into our difficulties? Because we have not sufficiently distinguished the various

[11] "On the discontinuity-theory, time, change, etc., would grow by finite buds or drops, either nothing coming at all, or certain units of amount bursting into being 'at a stroke.' Every feature of the universe would on this view have a finite numerical constitution. Just as atoms, not half or quarter atoms, are the minimum of matter that can be, and every finite amount of matter contains a finite number of atoms, so any amounts of time, space, change, etc., which we might assume would be composed of a finite number of minimal amounts of time, space and change." James, *Some Problems of Philosophy*, Ch. 10, p. 154.

meanings and contexts which the term has, we are the more easily led to regard time as a mysterious form or receptacle in which events somehow happen. Let us see whether we can treat this concept in a genetic fashion as we did space, and in this way succeed in relating each level to a context in which it becomes significant. We shall, I think, find that the preceding examination of space will aid us—especially in the study of kinetic and mathematical time. But there will also be important differences between space and time to note, due to the fact that each is *sui generis.* Each bears upon and introduces us to fundamentally distinct characteristics of reality.

The elementary experience which is at the foundation of what we roughly call time is the immediate feeling of change. "The mere fact that B follows A in consciousness does not of itself constitute the consciousness of B as following A. On the other hand, we must not jump to the conclusion that, because the sequence A B is not in itself the cognition of that sequence, it is therefore not experienced at all in any way. We must distinguish between consciousness of change or duration and change-consciousness or duration-consciousness. Change in consciousness may be felt without being cognized as change, and duration may also be felt without being cognized as duration."[1] What Professor Stout refers to here is the distinction between two mental levels. For instance, we can feel that there is a similarity between two objects long before we are able to analyze out the element which is essentially common to both. Cognition is a more reflective attitude which supervenes upon the relatively unreflective flow of experience. Probably no writer has brought out the significance of these feelings of change, these *transitive experiences,* better than William James; at the same time, James emphasized the difficult problem with which intro-

[1] Stout, *Manual of Psychology,* pp. 384-85.

spection is confronted in its search for them. "Let any one try to cut a thought across in the middle," he writes, "and get a look at its section, and he will see how difficult the introspective observation of the transitive tracts is. As a snowflake crystal caught in the warm hand is no longer a crystal but a drop, so, instead of catching the feeling of relation moving to its term, we find we have caught some substantive thing, usually the last word we are pronouncing, statically taken and with its function, tendency and particular meaning in the sentence quite evaporated."[2] As this writer points out, the denial that these transitive feelings or experiences exist has led to absurd mistakes in theory of knowledge. Sensationalism of the associational type was tempted into asserting that consciousness consists of sensations and their copies and derivatives "juxtaposed like dominoes in a game, but really separate." In other words, these early empiricists mistook the results of a partial analysis at a reflective level for the actual flow of experience and thus reached a false idea of the immediate data of experience. They reached such a false idea, not because reflective analysis is unveracious or falsifying, but because it was in their case controlled by preconceptions. They did not introspect delicately enough; they were too rough-and-ready and too biased. To-day, however, there is pretty general agreement that we feel change long before we analyze out the factors and think of them as in a sequence.

But the sense of change is only one of the elements which reflective analysis can note in perceptual time. Just as important is the feeling of duration or lapse of time. All individuals have an ability to estimate roughly the extent of duration of a process or activity. It is the task of the psychologist to explain the conditions of this sensing of duration. The indication is that it is connected, in part,

[2] *Principles of Psychology*, Vol. I, p. 244.

with certain recurring activities which help to give a rhythm to consciousness, and, in part, with what may be called the cumulative effect of the process of attending. "When we are listening to a sound," writes Stout, "our experience is different at the end of one minute from what it is at the end of two minutes, although the sound itself may not have altered in quality."[3] There is a qualitative difference in the experience, as time passes, which adds an experiential differentia to the sense of change and complicates it. The more we penetrate to the experience itself and remove, as it were, the images with which habit has veiled this experience, the more we realize its unique qualitative nature. If the aim is to be true to the experience itself, the picture of a stream or a line is totally inadequate. Let us call this interwoven sensing of change and duration the basic time-experience.

In personal time, we have, then, the immediate experience of both change and duration. These characters are data for the philosopher, although the psychologist may recognize it as his task to find their conditions. Moreover, we must admit that, as experienced characters, there is no contradiction between change and duration. A sense of the lapse of time fits in with the sense of change as its complement. While we cannot infer the one from the other, they harmonize so completely that there is reason to think of them as supplementary aspects of one complex experience. Both bear witness to the unity in diversity of consciousness.

The Specious Present.—The actual span of consciousness gives the experienced, or specious, present. This empirical present is not an indivisible instant of time but a changing span of some dimension. What its exact dimension is must be left to experimental technique to discover.

[3] Stout, *op. cit.*, p. 386.

The point to note is, that perceptual experience knows nothing of mathematical instants.[4] To assume them as is implied in the query, whether the felt present is made up of moments and is infinitely divisible, is to confuse levels and standpoints. It is the great advantage of the genetic method that it prevents the occurrence of such pseudo-problems.

The present is not an arrested span of consciousness but, rather all the consciousness there is. It is a flow whose content is always changing. "If the present thought is of A B C D E F G, the next one will be of B C D E F G H, and the one after that of C D E F G H I—the lingerings of the past dropping successively away, and the incomings of the future making up the loss. These lingerings of old objects, these incomings of new, are the germs of memory and expectation, the retrospective and the prospective sense of time. They give that continuity to consciousness without which it could not be called a stream."[5] If we disregard the complications introduced by memory and expectation, which represent an additional story added, as it were, to the current of perceptual happening, we are in a better position to gain clear ideas of the basic elements of the time-experience. These are developed and amplified by conception rather than changed.

The specious present is the moving content of the stream of consciousness. This span contains change of content, transitive feelings of a temporal sort, and felt distinctions which join with, and develop, the sense of change. In a

[4] "In short, the practically cognized present is no knife-edge, but a saddle-back, with a certain breadth of its own on which we sit perched, and from which we look in two directions into time. The units of composition of our perception of time is a *duration*, with a bow and a stern, as it were—a rear-ward and a forward-looking end. It is only as parts of this *duration-block* that the relation of *succession* of one end to the other is perceived.... The experience is from the outset a synthetic datum, not a simple one; and to sensible perception its members are inseparable, although attention looking back may easily decompose the experience, and distinguish its beginning from its end." James, *Principles of Psychology*, Vol. I, p. 609.

[5] *Ibid.*, p. 606.

chord of music played arpeggio, the various notes can be distinguished as both simultaneous and successive. They are heard together and yet in the order of succession.

Thus our perceptual experience presents us with four characters relevant to our idea of time, viz., change of content, sense of duration with a feeling of more or less, order of succession, and simultaneity. Along with these characters there is often another—the sense of growth or summation. This last character appears prominently in the experience of directed activity which has a goal. A more passive form appears in music. Heard melodies consist of tones which shade transitively into one another and yet mass together into a whole whose richness depends upon the musical capacity of the listener.

In the analysis of perceptual time, emphasis has usually been placed upon the irreversible order of succession characteristic of events. And yet, significant as this feature is. attention to it alone is apt to encourage a linear notion of time. It will be well for us to note the aspect of simultaneity of events as well as their succession. Simultaneity is the order of co-occurrence which characterizes many events. Consciousness is not thin and merely linear; instead, it is complex in content. I can hear the peal of thunder at the same time that I see a man scurrying across the street. In the busy streets of a city how many distinct actions can be noticed practically at once! We shall find that this order of events opens up a tremendous field for the imagination and lends itself to a significant development in science. Simultaneity will enable us to link time with space and give it a depth of location it otherwise is apt to lack.

The Addition of Memory and Expectation.—The "just past" and "not yet" of perceptual time are, it has been suggested, the germs of expectation and memory. But

the expansion of time which accompanies the growth of these attitudes and contents is critical, for it gives a reach and reference which is basic for time as a cognitive category of knowledge. The stability of our time-meanings —the past, the present and the future—depends upon this supplementation by a larger range of events than the "specious present" can offer. We are lifted to, and live in, a wider temporal horizon than perception permits. The events which are marshaled in order are ideas and not sensations. There is, in this freedom from the original limitations, something analogous to the movement from perceptual space to common, or empirical, space. Conception is, here, not something opposed to the nature of perception, but rather something which develops and ripens the potentiality of the latter. The train of successions opened to the mind by memories and expectations is held together in one massive series and touched by the vivifying flow of life; and the whole is suffused by that sense of change and of duration which we have seen to be so basic and primitive. Due to this contact, the higher level of personal time retains an individual flavor and reference. It has a direction, is never empty, and has the uniqueness of the stream of consciousness of which it is a part.

Common, or Standardized, Time.—This higher level of personal time shades insensibly into common, or standardized, time. What should particularly be noted is the infusion of a spatial framework through various needs, among which is that of interpersonal intercourse. We must not, however, jump to the conclusion that such intercourse is, alone, responsible for this introduction of space. The more subjective estimates of duration are found by the individual to be too dependent on emotions and bodily conditions to be trustworthy as standards guiding the phases of behavior. For these various reasons which re-

enforce one another, the individual is led to resort to changes in things conceived to be indifferent to these more fluctuating personal factors. Of course, this acceptance of the neutrality of processes in nature is confirmed and, in large measure, caused by the testimony of other who are not *at the same time* subject to our hopes and fears. It is, therefore, in the attempt to get beyond the personal equation in duration-estimation that stress is laid upon features of the physical world—the standpoint being here that of common-sense realism—which correspond to temporal order and harmonize with, or correspond to, the sense of duration. Does this standardization affect any of the time-characters? When rightly understood—as it not always is—it does not.

We have already emphasized an analogy between the conceptual development of time and the conceptual development of space. Another analogy is in order. Just as measurement by superposition is an advance upon measurement by the eye, because harmonizable with the latter and yet more exact and certain, so measurement of duration by motion is an advance upon a more intra-organic estimation. It must not be forgotten that the essential elements of change, order and duration remain unaltered.

Thus empirical time moves outward to nature. And this movement works in favor of the cognitive use of time in our knowledge of nature. Time becomes differentiated and, in one of its forms, fitted to become a category of the physical sciences. It is easy to understand how a chronology for the external world arose. A uniformly recurrent process would best serve as the standard, and, accordingly, the daily and yearly movements of the sun were adopted—with the historical result that history, or the process of the world, was reckoned by years, days, hours, etc. We are all of us familiar with this system, but we are not so familiar with the shift in time-estimation which occurs as we

pass from personal time to this standardized time. "Shakespeare tells us that time travels 'in divers paces with divers persons'; Newton tells us that time moves at a constant rate. Shakespeare's time is evidently subjective time, and Newton's objective time."[6] The contrast is between intra-organic time-estimation and measurement of events by commonly appreciated standards based on processes outside of the organism. No intuition of a literally objective time is demanded.

Mathematical Time.—Common time very easily links itself with mathematical space to become mathematical time, infinitely divisible and potentially infinite in extent. Hobbes has expressed this transformation so clearly and, withal, so naively that it will be well to quote him: "As a body leaves a phantasm of its magnitude in the mind, so also a moved body leaves a phantasm of its motion, namely an idea of that body passing out of one space into another by continual succession. And this idea, or phantasm, is that which (without receding much from the common opinion, or from Aristotle's definition) I call time. . . . And yet, when I say time is a phantasm of motion, I do not say this is sufficient to define it by; for this word time comprehends the notion of former and latter or of succession in the motion of a body, in as much as it is first here and then there. Wherefore a complete definition of time is such as this, *time is the phantasm of before and after in motion.*" Motion is one case of perceived change, a case for which measurement can easily be devised.

Movements are best represented symbolically by a line with a direction, thus ———>: in such a symbol, there is a quantitative character and also the characters of order and direction. Hence, the line symbolizes duration and succession. The minimal elements of the construction are,

[6] Stout, *op. cit.*, p. 498.

measurable line-room to represent the relative duration, and positions, apprehended together and yet thought of as successive to correspond to temporal order. Mathematical time, then, uses space as its measurable basis and superposes upon this a different kind of order, that of succession instead of coexistence.

Now, in our study of space, we saw that the more developed levels must not be substituted in a literal way for the lower levels. To think of perceptual space as really mathematical space disguised is to lay oneself open to all sorts of pseudo-problems. Mathematical space is, in part, a self-sufficient conceptual realm; in part, instrumental to knowledge about the physical world. There is continuity in spatial characters and also difference in their setting and use. In the same way, to seek to reduce personal time as an experience to mathematical time is absurd. *The time characters are present in both, but their setting is different.* Mathematical time is conceived by us to be infinitely divisible, infinite in extent, homogeneous and empty. The characters are abstracted from their plangent source. It is against the identification of personal time, as the interwoven flow of conscious life, with space-time that Bergson rightly objects.[7] *But the flow of life is not time as a category.*

Kant's Antinomy.—Mathematical time is, as it were, the abstracted order of common time thrown upon the background of space. It is a conceptual construction reflecting essential characters and yet characters here loosened from

[7] "Were I to look at it closely, I should see that this abstract time is as immobile for me as the state which I localize in it, that it could flow only by a continual change of quality, and that if it is without quality, merely the theater of the change, it thus becomes an immobile medium. I should see that the construction of this homogeneous time is simply designed to facilitate the comparison between the different concrete durations, to permit us to count simultaneities, and to measure one flux of duration in relation to another." *An Introduction to Metaphysics*, p. 46. I fear, however, that Bergson forgets that temporal order is qualitative.

their normal content, which is events and changes. We can note the order in which all events do come and consider it apart from any particular events. The order is, in this sense, the form of all possible events which must be simultaneous and successive with respect to other events. Thus there is a fundamental continuity between the genetic levels of the time-experience, what may be called an identity of essence. Mathematical time can, therefore, be instrumental to knowledge of the physical world in a way completely analogous to the space of mathematics. The material of knowledge is given in perceptual experience; and yet the more conceptual stages, which mental operations produce, develop and employ this material for conscious ends.

This identity between the essential characters of common and mathematical time being granted, we can proceed to discuss Kant's famous antinomy. We shall see reason to believe that it is as much of an error as that which was directed against the validity of space. Naturally, we shall grant to Kant that neither space nor time is a thing-in-itself. Our different epistemology sets a new formulation. We ask, Is time a category potentially or actively interpretative of the character of reality?

Kant seeks to prove the thesis that the world has a beginning in time by showing the absurdity of the opposite proposition. "For if we assumed that the world had no beginning in time, then an eternity must have elapsed up to every given point of time, and therefore an infinite series of successive stages of things must have *passed* in the world. The infinity of a series, however, consists in this, that it never can be completed by means of a successive synthesis. Hence an infinite past series of worlds is impossible and the beginning of the world is a necessary condition of its existence."

What we are here really dealing with is our conception

of time. Time is an order of successive events. Let us take a line and consider any arbitrary point as the present. Does it follow that I must think of the portion of the line, which extends to the left and symbolizes the past, as finite? Assuredly not. One of the initial mistakes of Kant was to start with an assumed past moment and work toward the present instead of with the present and working backward. So far as our thought follows the method of synthesis, we begin with the present; and the infinity of time means that there is no conceivable end to the movement into the past. Kant speaks as though time were a stream flowing into the present. There is a double danger in this approach: the image suggests a source, and we confuse our thought with the flow of things. An infinite flow does not involve a human synthesis of an infinite collection of events. The critical realist does not demand too close a parallelism between the process of thought and the process of reality. Thought is retrospective and supervenes upon reality. Hence, to think of the world-process as without a beginning is an empirical affair of which we find ourselves quite capable.

Time as a Scientific Category.—What kind of knowledge of the physical world does time cover? We shall realize in the case of time, even more clearly than in that of space, that human knowledge is not an intuition of the physical world. Knowledge implies intuited material and the use of that material in a cognitive way, but what is intuited is mental and not the physical object.

The first point to note is the character of the measurements upon which science builds its facts. Scientific time is at once a measurable quantity and an order of succession. Some process—preferably a movement—is taken as a standard, and other processes are referred to this unit. If two processes begin and end at the same time, they "occupy"

the same time. Let us take an example to make this method of measurement clear. Suppose that we wish to know how long a certain chemical process takes. We note the positions of the hands of a watch at the moment we put the chemicals together and also at the exact moment the reaction ceases. We measure the one process in terms of the other standardized one to which we relate all other processes. This measurable correspondence is the type of scientific time-quantity, and it is for temporal knowledge what the superposition of things is for the spatial knowledge of nature. In both cases, our knowledge consists of ratios, not of intuitions of inherent properties. Perception is a means to knowledge.

The standard process which science has adopted is, we have said, movement. It might have been other processes like the loss of heat by bodies, but practical conveniences led to the selection of movement. The point to stress is, that the prime requisite of the reference-process is its capacity for exact measurement. That processes, as we say, occupy time means two things: first, they are experienced by us as corresponding to an immediately estimated duration; second, that there are changes of a successive order. The scientist undertakes to measure these aspects and relate them to one another. What process is selected as a standard of reference and what unit is adopted are arbitrary so far as nature is concerned—a fact that makes us realize that knowledge is a human affair and is knowledge about nature rather than a reproduction of something external to man. But the ratios secured are not at all arbitrary. Given the method and the unit, and the result is determined by reality itself. Nature dictates a response to man's questions. But the questions and the language of the response are human.

When the thinker reaches this conclusion, he is led to seek confirmation in the more theoretical reflections of

scientists themselves. And it is interesting to find that scientists are more alive to-day to such questions than ever before. In every field there is an increasing demand for exact definition and discriminating analysis. In regard to space and time, the theory of relativity has produced a marked degree of reflection. Thus in his examination of the theory of relativity, Dr. Silberstein treats of the "definition of physical time or the selection of a clock or time-keeper, to be employed for the quantitative determination of a succession of physical events."[8] Let us consider his summary of the method adopted by science to work out a suitable standard.

"Suppose," he writes, "we do not limit ourselves to the investigation of motion only, but are concerned with every possible kind of physical phenomena, such as conduction of heat or electricity, diffusion of gases or liquids, melting of ice, evaporation of a liquid, etc., and that we propose to describe the progress of these phenomena in time, to trace their history, past and future. How are we, then, to select our time-quantity t?" Newton's absolute time flowing at a constant rate—whatever that may mean—could not help us since we have no clock to measure this absolute time. The result is that science selects some standard process like the rotation of the earth and adheres to it so long as it can relate other processes to it. When this cannot be done with ease, the standard process is examined more thoroughly to see if it is variable. "Thus astronomers have come to the conclusion that the earth as a clock is losing at the rate of 8.3 seconds per century and they have given up the earth as their time-keeper and substituted for the sidereal time t a certain function $T = \varphi(t)$, slightly differing from t, as their new 'kinetic time.'"

It is obvious that science has relinquished that naively realistic attitude toward kinetic time which still lingered

[8] Silberstein, *The Theory of Relativity*, Ch. 1.

in the mind of Newton. The above analysis of scientific time fits in exactly with the position which our own critical analysis forced us to take. The universality of scientific time follows from the identity of the reference made. We may say that the whole physical world is in *one* time: when properly analyzed, this only means that the same, identical process can be brought into relation with all the physical processes which we know.* Hence, the oneness of the world's time is expressive of the fact that all processes in nature can be compared and measured by human ingenuity. The world is spatially one, and so it lends itself to these comparisons.

An interesting result, which we might otherwise have missed, now stares us in the face. The unity of scientific time really rests upon the spatial unity of the physical world. The processes of change which are measured are changes in the physical world, localizable with respect to each other. We move our eyes hither and thither to note the changes which are running their course and keep tab of them in the light of the movements on the clock's face. It is obvious that the unity of scientific time implies the spatial character of nature. These two fundamental, and yet elementary, quantities hold of the same world. The elements of the two quantities are, however, essentially different. Space signifies order of coexistence in distance: its character comes out best in the experience of solidity. The idea of change is alien to its content. When we think of nature in terms of it, we think of coexistent bodies whose parts exist alongside of one another. Time, on the other hand, signifies an order of change qualified by duration. Such change we think of as *in* bodies. The distinctness of the two categories can be brought out in this fashion: Conceive of the physical world as inert and changeless. Would

* The modern theory of relativity deals with the assumptions underlying measurement. It has led to an analysis of scientific space and time long needed.

time have any meaning for such a world? But our world is different. It is both spatial and temporal. Only when we think of it in terms of both do we grasp it properly. Thus they are co-valid of nature. Physics recognizes this correlation in the acceptance of the four-dimensional manifold of space-time.

Temporal Distinctions.—Let us next glance at certain distinctions characteristic of personal time in order to see whether we should carry them over to time as a category of scientific knowledge about nature. I refer to the time-meanings, the past, the present and the future. In personal time we distinguish the now from the past and the not-yet. It will be remembered that in perceptual space we distinguish the here from the there, chiefly with reference to the organism. What becomes of the temporal contrasts at other levels?

The present of common time is more a construction of arbitrary limits. It may be a minute, a day, a year, according to the context and interest. This relative character of the present holds also for mathematical time, for in it there is nothing to distinguish one moment from another except their order. The present of such a time is an arbitrary portion of time-room which can be made as small or as large as desired. There is no present in its own right in mathematical time. The situation is analogous to the arbitrariness of any "here" in mathematical space.

But what shall we say of the present for kinetic, or scientific, time? Does our knowledge of nature reveal a present which stands out in an absolute sense and can be measured? Obviously not. What science offers us consists of processes which can be correlated with the accepted time-intervals. Theoretically, such an interval can be made smaller and smaller; practically, this process of comminu-

[9] We shall examine the question of continuity elsewhere.

tion has a limit set by technique. The general measurements which are obtained in science give quantities which can be treated as infinitely divisible. Whether the natural process itself is of this type remains, however, to be seen.[9] The preliminary knowledge which gross measurement contributes is incapable of answering such a penetrative question. Be that as it may, it follows that kinetic time offers no natural present in any way analogous to the specious present of consciousness. Let us not, however, condemn science for giving only the sort of knowledge it can obtain.

Change the Objective Basis of Scientific Time.—If time be an order, it must be an order of something. In our own consciousness, it is an order of experience. What do we think of as in an order of succession in nature? The answer which leaps to our minds is change. Real time is change, or, to put it the other way around, change, as cognitively conceived, always involves an order of succession.

But the character of real change is, itself, a problem. Is change continuous or discontinuous? Again, does change involve an order in nature? We must postpone the detailed consideration of these questions to another chapter, but certain points may be noted now. In the first place, change in consciousness seems to involve both continuity and discontinuity. There is often no preparation for what happens. Thunder breaks in upon silence in a cataclysmic way. The principle of the threshold, likewise, suggests abrupt transitions. But it may be retorted that the nervous system carries the increasing strain cumulatively. To this it may be replied that there are different rates of change, and that nature often works like a gasoline engine by a series of quick explosions. At other times, change seems to be progressive and continuous.

When we ask ourselves whether change involves an

order of time, the answer seems clear. Change in consciousness does so, for that is the exemplar from which the category of time is derived. But when we think of changes in systems independent of consciousness, a difficulty arises. The past ceases to exist, and there seems to be no natural present. Knowledge about nature is not the same as nature, and we have a right to expect a divergence between the form of knowledge and reality. Let me illustrate the point. The scientist furnishes us with knowledge about a motion by describing the *path* traversed and the time-rate of the motion. But the body moving does not carry its path with it. Only man with his memory is able to connect a past position with a present one. The moving body has no such coordinating memory. When this difference is once grasped, we realize that knowledge about a motion is not the same as the actual motion. Paradoxical as it may sound at first, we must admit that nature produces events *according to an order* and that man arranges them *in an order*. The stretched-out order of past and present is founded upon nature and agrees with nature but does not exist in nature. Knowledge and reality are not identical.

The "now" is present experience in contrast to past experience, which is remembered, and future experience which is anticipated. The remembering and the anticipating are present, while what is remembered is dated as past and what is anticipated dated as future. A little care would avoid all difficulty here. We should say that events are past rather than in the past. What we mean is, that certain processes or activities have ceased, though they once did occur. Their existence was their presentness. The "now" of nature is what is going on there.

It follows that temporal contrasts should not be read too naively into nature. When we come to consider the category of causality, the importance of this warning will appear in all its force. Can the cause, which is past, pro-

duce the effect which is present? Our analysis of time will enable us to meet such questions with assurance.

Real time is change: but what is change? Does it imply activity? Consciousness is a stream whose content is changing, that is, old content lapsing and new content coming. It is not a *thing* which changes so much as a series of changes. But when we think of the physical world, we conceive of it as *that which* changes or in which changes occur and not as a series of changes. If we can master a metaphor, we can say that "nowness" of nature is the reality of the things of which it is composed. In our thought of reality, we get rid of that threat of transiency which qualifies consciousness and gives much of its sadness to the present moment. It is evident that we are here on the track of the category of substance, of that which is the seat, source and center of change but whose existence is not imperiled by change. It is reality which changes and at the same time persists.

A Return to Kant's Antinomy.—To those who have grasped the implications of the above analysis, it will be clear that the usual view has been reversed. Instead of nature being in time, time (change) is in nature. So understood, time suggests neither beginning nor end to the world.

Had the world a beginning? We do not ask whether it had a beginning in time. Now, if the world had a beginning, it must have been because it was created, or because it arose out of nothing. But is there any good empirical reason which suggests creation? Is not the burden of proof on those who assert it? Science possesses no data which lead in that direction. To those who protest that they are forced to think of a beginning, it may be pointed out that they concede that God is eternal. It is evident that the thought of an eternally existing reality is a

common possession. Let us pass to the other alternative While I can't absolutely disprove that the world arose out of nothing, I find the idea opposed to all the tendencies of my thought which urge me to seek a cause for what comes to be. We are here face to face with the so-called problem of being.[10] As James has so well said, "Not only that *anything* should be, but that *this* very thing should be, is mysterious! Philosophy stares, but brings no reasoned solution, for from nothing to being there is no logical bridge."[11] But philosophy is essentially an attempt to understand the world as it exists. And, besides, not-being is a concept founded upon being by negation.

The complementary problem—Is the physical world eternal?—can be discussed in a few words. The position taken toward the previous question implies the answer to this one. The facts are in favor of conservation of some kind. What it is that is conserved is another matter and will demand consideration later. If the universe be a spatial system, what holds of subsystems can be applied to reality as a whole. The more science secures data in favor of conservation, the more it urges on us the view that nature is eternal. And by eternal I mean, not changeless, but never ceasing to exist.

Summary and Suggestions.—In the previous discussion on Space, we were led to the conclusion that spatial judgments are valid of nature and that the elements of the spatial category, such as distance, position and order, correspond to, and reveal, the structural character of the world. But we also realized that these elements appeared in those innumerable detailed judgments which constitute science. It was their commonness which constituted space a genuine category of knowledge. What is true of space

[10] Cf. Schopenhauer, *The World as Will and Representation,* Appendix 17.

[11] James, *Some Problems of Philosophy,* p. 39.

is also true of time. Temporal order and measurements give us knowledge about nature. Yet these categories require development and deepening: they are apt to be conceived in too passive and mathematical a form. While space blossoms out, with the increase of knowledge, into the categories of dynamic relation and internal organization, time deepens into the idea of processes of caused change. Dynamic elements enter to give body and energy to our concept of nature. Into the framework furnished by space and time all the other categories fit. No valid predicate can conflict with them. Reality is spatial, and this spatial reality changes.

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THE PSYCHOLOGY OF RIBOT AND CONTEMPORARY THOUGHT.*

THE conditions of speculation that had become established by French thought for two centuries were completely overthrown by the events of 1789 and the social revolutions and political upheavals which took place in the nineteenth century. Instability and *malaise* are such important factors that the groups in power are compelled to dread the temporary character of scientific truth and to enlist philosophers in defense of the beliefs to which they owe their cohesion. To eclecticism first, and then, under the July Monarchy, to spiritualism, they set the task of confronting free research with thoughts placed in the service of social truths. There comes into existence an esthetic doctrine of feeling which flatters the secret needs of the inner life, captivates attention and prevents due apprehension of the full scope of the scientific movement. After the tempestuous days of July, this doctrine denounces the tendential, provocative and revolutionary character of positivism, against which it pronounces sentence of exclusion, the surest effect of which is to discredit the work of biologists, positivists and the critical school, and to hand over opinion, in a defenseless condition, to the action of Anglo-Saxon ferments. Now, in England and Germany, where science is mainly of a technical and utilitarian nature, scientific evolution has not aroused the effort of critical reflection which is one of the fundamental tenden-

* Authorized translation from the *Revue de métaphysique et de morale* for Nov.-Dec., 1919 (XXVI, 6, pp. 739-763) by Fred Rothwell.

cies of French philosophy; it has merely brought to birth a new emotion. Urged on by collective disciplines and needs, speculation becomes enfevered and the rhythm of thought is accelerated; the study of life, civilizations, languages, peoples, religions, customs, literature and art has revealed the incessant becoming which moves beneath beings and institutions and which the stereotyped processes of the intellect are powerless to hold and to stabilize. To obtain the mastery, there is needed the combination of two hostile powers: feeling and a more uncompromising science. At the cost of a reconciliation, wherein we see a degeneration of science and artistic sensibility, which have both become impoverished, there arise such metaphysical systems as those of Schelling, Hegel and Spencer. Widely known in France, they bring about a philosophic diversion and give thought a fresh orientation, a new conception of human experience which sets free the passional elements of our nature and the blind forces of the world.

It was in such an atmosphere that the personality of Ribot was moulded.

I. RIBOT AND HIS WORK.

An easy, mobile and somewhat dreamy sensibility, hostile to constraint of every kind; a gift of comprehension and assimilation, along with a natural *finesse*: all these make Ribot peculiarly susceptible to the influences of the period in which he lived. Enamored of the spirit of truth, he desires to know the essence of things; all the same, he received from the vague teaching of his masters—where we see naturalism working along with the dynamism of Leibniz and Maine de Biran—neither the scientific mind nor the discipline which reveal to the young man the world of ideas, and rouse in him that intellectual emotion without which there can be no profound attachment to truth. Besides, in himself he possesses too keen a sense of the con-

crete, of the complexity of the real, of the true quality of beings and things, not to be speedily convinced of the poverty of logical measures, not to distrust thought itself. On the other hand, his impressionability and the measured character of his imagination do not allow him to find motives of uneasiness in inner meditation, to see in passionate outbursts more than a temporary alienation of the person, or to seek in his dealings with men and the daily intercourse of life for the elements of a moral or plastic creation. To him, being seems to bear within itself only a false and deceptive power. And Ribot, who secretly despises unactual considerations, is instinctively carried out of himself and feels drawn toward the philosophic, human or artistic works of his age. These he studies with a sympathetic curiosity sufficiently mistress of itself for no play of metamorphosis to distort their proportions and contour; and sufficiently plastic to discover, beyond the concatenations, the dialectical oppositions and the technical modes of expression, the emotion that animates them. He tends only to find his own particular tendencies in the study of contemporary tendencies; he tends only to acquire directions. The critical consciousness of modern sensibility becomes the first moment of a capture of self-consciousness. Still, however immediate they appear, the paths of feeling are frequently but the more tardy and uncertain. Ribot is so ready to grasp detail that he finds some difficulty in withdrawing from the diversion of impressions; his critical proceedings have long betrayed a kind of timidity, a defect of intellectual assurance, so to speak. Like Stendhal, he attained to complete self-possession only at a very late period of his life, when he was about forty years of age.

First we see him yielding to the fashions of the time, his infatuation for English thought which openly breaks with positivism[1] and secretly accepts the Biranian spiritual-

[1] *La psychologie anglaise contemporaine* (1870), pp. 100-103 and p. 244.

ism of the "School." In Stuart Mill and Spencer, Ribot finds again the same concern for the concrete man, the same freedom of investigation, the same latent metaphysics, the same sense of life in which the contrast is brought out with the little he yet knows of French thought, the traditions of the "School." He forgets that in them may be found the survival of the discipline which insures the perennity of the work of the ideologists and of Auguste Comte, the survival of the mental habits to which the opposition of eclecticism to science prevents their precise signification from being restored. Above all, he sees that there is being effected a seizure upon the intellect, which the Restoration, the Monarchy of July, and even to a greater degree the Second Empire have converted into too docile an instrument of power. From the year 1870, in the *Psychologie anglaise contemporaine,* he reacts less against French thought than against the Imperial University, at all events as much against a meanness and a servility which shock the conscience of a Vacherot, a Taine or a Renouvier as against the formal and metaphysical tendencies of instruction.[2] A work of political quite as much as of philosophical polemics, and even more so, the *Psychologie anglaise,* in which reasons of feeling outweigh those of logic, contrasts the obligatory moralism of the Empire as well as the authoritative dogmatism of Comte with the free criticism of the English, who, guardians of the tradition of all great scientific minds, have succeeded in safeguarding that "freedom of investigation without which there is no philosophic mind." Following their example, he desires to maintain in us our integrity of character and the free play of the critical faculties. At the same time, Ribot contrasts the forces of the past with those of the present; he distinctly proclaims the irremediable disrepute of meta-

[2] Cf. Ribot's article "M. Taine et sa psychologie" in *Revue philosophique,* 1877, p. 25, and Renouvier's *Essais de critique générale,* 2d Essay, "Traité de psychologie rationnelle," 1912 edition, Vol. I, p. 156.

physics, the coming of a scientific era and the liberation of psychology. In him is concentrated the entire secret work of the Second Empire. His simple, unstudied and direct exposition renders these new truths accessible to all who remain outside the operations of the school, the subtilties of logic and the refinements of culture; and who value scientific knowledge according to the practical facilities it provides. Thus there comes about the *annonciation* of a mental revolution.

But this reaction against a form of thought that sprang from the eclecticism of Cousin and holds sway in Latin countries is inadequate; it risks being ineffective if the materials of psychology continue to be wanting. All the works undertaken by Ribot during a period of ten years: on Hartley, on heredity, on Schopenhauer's philosophy and Taine's psychology, on contemporary German psychology, his translation of Spencer's *Principles of Psychology* in collaboration with Espinas, the lucid criticism of which determines the essential traits of the biological movement and of experimental psychology in Italy, the foundation of the *Revue philosophique* in 1876—all have one and the same end in view: to bring before the French public a new way of dealing with the phenomena of consciousness, to place at their disposal the effective instruments of Anglo-Saxon thought, and to spread broadcast the results obtained. This vast preliminary survey, comprising the work of Stuart Mill, Spencer, Bain, Herbart, Wundt, Lazarus and Steinthal, and Horwicz, shows how numerous are his attempts at a revival of psychology. The study of animals, human physiology and pathology, the study of languages and civilizations, have made it possible to set up new branches which are assigned to descriptive psychology: comparative psychology, morbid psychology, evolutionary psychology, the study of character. The English school, rich in *ensemble* works, is still mainly systematic and

descriptive; the German school, rich in monographs, aims at a greater scientific strictness by the application of technicalities peculiar to experimental sciences. Both of these, however, show common characteristics. Imbued with the principle of evolution, they recognize that the study of the human soul can be no more than a study of its genesis and its dynamism. Abandoning all ontological speculation on the nature of consciousness, alien to spiritualism and to materialism alike, they tend only to seek in biological and social factors for the *conditions of existence* of the phenomena of consciousness. Psychology becomes "the study of the phenomena of mind in all animals by considering them, not in their adult form, but in the successive phases of their development." Consequently, it is a science which sets before itself an end analogous to that of the sciences of life. The descriptive method of the English, the delicate processes of experimental psychology and of psychophysiology, the complex technicalities of the psychophysicists which are substituted for inadequate introspection and *esprit de finesse,* tend only to give psychology an ever greater exactitude. And Ribot insists on setting all these forth with like impartiality, without regarding his personal preferences; he is anxious to prejudge no result and to leave the path open to all methodological attempts made in the most varied directions. For it is advisable that each mind should retain its freedom to collaborate in an impersonal and international work of science in the form which best appeals to its character and capacity and to the distinctive genius of the nation to which it belongs.

Nevertheless, when brought in contact with foreign thought, Ribot finds his distinctive originality and gradually discovers his own particular tendency. He advances prudently and circumspectly, not forgetting that psychology has only just issued from the realm of metaphysics, that its first consideration should be to establish itself as

a science by becoming objective, and that it would be somewhat hasty to attempt to introduce, into the study of psychological phenomena, measure and calculation and the quantitative method that are proper to those sciences that have reached maturity.[3] In this transitional period, wherein alone the *qualitative* method is necessary, we must guard against attributing too much to physiology "for the psychologist derives no advantage from insisting on a physiology that is devoid of solidity";[4] all exclusivism and intransigeance are opposed to the spirit of induction. There is no necessity to receive a scientific credo or to profess unadulterated empiricism. To demonstrate that ontological preoccupations must remain foreign to psychology is not to dismiss them in imitation of Auguste Comte; Ribot willingly acknowledges that these preoccupations correspond to a legitimate necessity of the mind,[5] and he confesses that "it is perhaps a necessity inherent in all psychology, even experimental, to start from some metaphysical hypothesis."[6] Thus, Ribot is consistent all the time. The conciliatory and supple attitude he naturally adopts is in conformity with an empiricism which, less critical than the empirical rationalism of Claude Bernard, accepts as objective facts even the suggestions of one's inmost experience. In the absence of all speculative or moral preoccupation, the profound impression that feeling possesses a concrete reality, a sort of sentimental mysticism, the dialectical confirmation of which Ribot finds in the *World as*

[3] *L'hérédité* (1873), pp. 217, 218, 219, 220-221. Cf. *Psychologie allemande contemporaine* (1879), pp. xx-xxi.

[4] *Maladies de la personnalité* (1885), p. 166. Cf. *Psychologie anglaise* (1870), p. 109. "Deliberately to reject the resources of psychological analysis and thus to build up the theory of mind on nothing more than the data which physiology can at present supply, I look upon as a mistake. However imperfect be the science of mind, I have no hesitation in affirming that it is far more advanced than the corresponding part in physiology, and to leave the former for the latter seems to me an infraction of the true rules of the inductive method."

[5] *Psychologie anglaise*, p. 21.

[6] *Psychologie allemande*, p. 28.

Will and as Idea, gives direction to his investigations. The dull effort of feeling chooses the elements of crystallization from among the tendencies of contemporary psychology and biology. Ribot thinks less of making a thorough examination of the study of mind than of undertaking the study of feeling, which is more in accordance with his inclinations. Now, contemporary schools, engrossed in questions of sensation, perception and imagination, have scarcely touched upon this study; in Spencer, Bain and Horwicz we hardly find anything but outlines, analyses and suggestions; whereas Taine's historical labors prevented him from giving to the *Emotions and the Will* the close investigation which his book *On the Intellect* demanded. It is in Schopenhauer's attempt to reach, beyond the abstract mind and the empty forms of thought, a concrete reality constitutive of the individual, that Ribot finds fertile suggestions. Schopenhauer restores its autonomy to the psychology of feeling by giving to Bichat's classic distinction between organic life and animal life, as generally accepted in the nineteenth century (by Comte and Spencer, among others), an interpretation free from any intellectualistic preoccupation. Organic life, which is primitive though secondary to philosophers eager to place the specificity of the psychic in the higher forms of the mental life, becomes fundamental and preponderant to the metaphysician who desires to reach the very heart of being. Consequently, Ribot transposes this metaphysic of the Will into terms of positive thought and enters into possession of a working hypothesis the terms of which he asks biology to define.[1]

While the French school is flourishing, scientific circles begin to see that an anatomical knowledge of the brain affords no knowledge of cerebral functions; the theory of cerebral localizations, which has been substituted for phrenology, has been reduced to its right proportions; the recent

[1] *Philosophie de Schopenhauer* (1874), pp. 71-73.

discovery of the pneumo-gastric and of the great sympathetic as autonomous systems independent of the nervous system, the investigations of Claude Bernard on irritability and organic sensibility, the clinical and anatomic-pathological studies made possible by the work of Charles Robin in general anatomy and undertaken at the suggestion of Charcot, enable us to become better acquainted with organic life, its workings and its relations to mental life. Influenced by this scientific current, Ribot, who has an inductive mind, a taste for "factual detail, psychological curiosities, exceptions without which we cannot get to the root of things,"[8] and who has found in Taine's method a confirmation of this taste,[9] half separates himself from Spencer's ideological system of which he retains only the postulate according to which the principle of evolution springing from embryology and extending to the development of the species is applicable to mental life, along with the theory of mind as a function and a mechanism for adapting oneself to the outer world. But he dreads too much "the somewhat scanty clearness of Condillac and Destutt de Tracy" not to part company with Taine. He begins to study medical jurists and French alienists, and in the uninterrupted sequence of investigations into mental pathology undertaken by Pinel, Esquirol, Lélut, Moreau de Tours, Baillarger, Cerise, Longet, Duchenne de Boulogne, Durand de Gros and Brière de Boismont, he gives evidence of the method of the clinician, the positive spirit and an aversion from the systems which characterize the works of the ideologists. He then attains to the idea of his pathological method, and, without suspecting it, resumes

[8] *Philosophie anglaise,* pp. 249-250.

[9] Taine, Preface of *L'intelligence* (1870) and *Correspondance,* Vol. III (4th ed.), p. 253, letter to Jules Soury. "The novelty of my book consists in its being entirely made up of trifling facts, significant instances, individual observations, descriptions of atrophied or hypertrophied psychological functions." This method, common to Taine and Ribot, is also in a sense the one used by Destutt de Tracy. Cf. R. Lenoir, "Psychologie et logique de Destutt de Tracy," in *Revue philosophique,* December, 1917, p. 532.

connection with one of the most fruitful and one of the most misunderstood epochs of French thought. This contact, after a constant and profound study, brings about a reconciliation between his nature and the tendencies of his age.

Then only, when about forty years of age, within a period of thirty years during which the German school declines and becomes eclipsed by the prestige of the American school, Ribot brings his contribution to psychology in the form of monographs and memoranda dealing with special subjects. Circumstances, the necessities of instruction, the inevitable variations of thought, impel him by degrees to extend his domain, to pass from the lower to the higher functions, to pure psychology, to substitute for the pathological method originally employed in studies on memory, personality and will, a descriptive method more compatible with the study of attention, general ideas, feelings and the creative imagination. Still, it would not be quite correct to judge by the outer decisions of his thought in interpreting this modification as an implicit recognition of the barrenness and inadequacy of experimental psychology. In Ribot the transformation came about "slowly, involuntarily, almost without his being aware of it." It is nothing but an expansion of his nature. Remembering the profound influence that the *Maladies de la mémoire* had exercised over the minds of men and seeing an ever more fruitful school of mental pathology, Ribot's critics might have thought there would follow a rupture; they located his originality as being where exclusively it was not, as being in some technical process. Now, Ribot's method, though occasionally pathological, is *concrete* in its essence. Ribot indeed knew, as did Claude Bernard, that "the true method is that which holds in the mind without stifling it, and which, as far as possible, allows it to face itself; which guides it and at the same time respects its creative originality and the spontaneity of science: most precious qual-

ities." Like him, too, Ribot made a profound impression only because he did not doubt his own spontaneity and was able to establish a secret unity between his nature and his work. In every subject he investigates, he keeps close to the concrete individual. This sole aspiration insures the inner coherence of a work from which all logical unity appears to be absent, the life of a work whose immediate or distant reverberations have moulded European thought.

II. THE PSYCHOLOGY OF RIBOT.

Too long has psychology regarded consciousness through the forms of thought, used the analytical method, accepted abstract and formal appearances, and thus failed in its essential duty: to get at the concrete being, the real person.

Now, mental activity cannot be decomposed: the person forms a synthetic whole the apprehension of which eludes both analysis and an intuition of consciousness which lasts scarcely more than a few seconds. States of consciousness, discontinuous and always unstable, are raised up and supplant one another by a transmission or a conflict of forces of the nervous elements which produce them within the limits of the present.[10] If they are not "will-o'-the-wisps which alternately shine and die out," it is because there is something that unites them. This bond, which some have regarded as a transcendental entity and others as a form which keeps the sensations piled together, as it were, cannot be given by reflection, since the real personality does

[10] Ribot rightly insisted on the fact that the present alone is given in consciousness. Cf. *Evolution des idées générales* (1897), p. 181. "The present has the privilege of appearing before consciousness as the duration-type, the standard, the measure to which everything should be related: and it cannot be otherwise, since indeed (a thing too frequently forgotten) we live only in the present; the past and the future do not exist for us, are known by us only on condition they become present and occupy our present consciousness. The present is the only psychological element which, consciously or unconsciously, gives a content and a reality to duration. It is essential to rid oneself of the opinion, sanctioned by many authors, that the present is only an inapprehensible moment a transition, a passing, a flash, a mathematical point, a zero, a nothing: on the contrary, it is it alone that lasts, now for a long, now for a short period."

not assert itself by reflection, but by acts. "To grasp the real concrete personality and not some abstraction which takes its place, is not simply a matter of retiring into one's consciousness with closed eyes and obstinately questioning it: on the contrary, we must open our eyes and observe. The child, the peasant, the workman, the millions of people in street and field who have never heard mention of Fichte or of Maine de Biran, who have never read a single dissertation on the self and the not-self, nor even a single line of psychology, each have their own distinctive personality and instinctively affirm it every moment of their lives."[11] This instinctive affirmation dwells in the vague feeling of the body; the spontaneous, natural feeling of our self, present in every healthy individual, is the expression of the coordination and the consensus of the organism. "This coordination of the innumerable nervous activities of organic life is the basis of the physical and psychic personality, all other coordinations depend upon and are added to it; it is the interior man, the material form of his subjectivity, the final reason of his mode of acting and feeling, the source of his instincts, feelings and passions, and, as they said in the Middle Ages, his principle of individuation."[12] Consequently, the self in its simplest form is a coordination of psychological tendencies and states whose proximate cause must be sought in the concurrence of the vital energies. The continuity of the mental life arises from the continuity of the organic substratum underlying it; and the psychological expression of cœnesthesia is found in the character.[13]

If we now follow the order in which the psychological functions appear in specific evolution and in individual evolution, we find that they have their source in character. The pathological study of memory, will and personality

[11] *Maladies de la personnalité*, p. 88.

[12] *Ibid.*, p. 161.

[13] *Maladies de la volonté* (1882), p. 30.

at least establishes this irrefutably, and enables us to hit upon the law of dissolution. Thus, according as we quit purely organic states and pass from physical into affective, and from affective into intellectual states, we find that they express the totality of individual tendencies, then a smaller and smaller part of the individual tendencies, until the activity of the physical and that of the social environment almost completely take the place of that of the person. As psychological phenomena become more complex, their physiological importance decreases and their motor power diminishes. These preliminaries prove that the character is really at the starting-point of all psychic phenomena, whatever be their degree of complexity.

And so the psychologist's task is defined. Reversing the order followed by the intellectualistic psychologists, he must circumscribe the distinctive contribution of the person in the life of the mind, in contrast to the contribution from the outer world, and must determine its nature and modalities. No doubt the work is a complex one for we must take into account the intervention of factors that have appeared at different moments of evolution. The direct data of biology and the indirect data of pathology, however, prove that irritability, which is constitutive of the individual, develops along two parallel lines, motricity and sensibility, in which the whole of psychology will shortly subsist.

* * *

Since consciousness manifests itself in change, and change has its first condition in movement, movement shows itself as the fundamental condition of knowledge. Motor activity is at the very starting-point of mental life, and motor elements necessarily appear in the constitution of all our states of consciousness, either as bodily movements or as kinesthetic sensations or motor images. For not only are our movements accompanied by distinct specific sensa-

tions, links between the organic and the special sensations. but we also retain, within ourselves, images that represent movement, and we possess a motor memory which allows of the revival of the external movements themselves. For "if the motor apparatus had not its own memory, images or residua, no movement whatsoever could either be learned or become habitual."[14] Accordingly habits, motor manifestations, are included in tendencies, in the specific sensations of sight and hearing,[15] in ideas,[16] in the "dynamic" assocations which constitute the effective conditions of memory,[17] in the immediate associations resulting from a kind of irradiation of movement and in the mediate associations resulting from a kind of transmission of movement. Thus, in the various modes of knowledge, the motor element is seen to have its place as an intrinsic part of a complex whole.

Certain phases of the mind, such as doubt, surprise, conviction, astonishment, belief[18] and attention, which Ribot had investigated long before a psychology of attitudes had been constituted, seem to correspond to a particular mode of motor activity, devoid of matter and content, "an extrinsic means of support and resistance without which states of consciousness would remain a plastic and fluid matter." Thus, "motor activity permeates and envelops our psychic life and constitutes the solid part of it. Physiologically, it depends on the motor nervous system, both central and peripheral, acting in voluntary or spontaneous impulsions, and also on the sensitive nervous system which transmits the kinesthetic impressions to the cortical layer of the brain. Psychologically, in the form of presentations

[14] *Psychologie de l'attention* (1888), p. 78.

[15] *La vie inconsciente et les mouvements* (1914), p. 28.

[16] *Evolution des idées générales,* p. 147, and *Psychologie de l'attention,* pp. 75-86.

[17] *Maladies de la mémoire* (1881), pp. 50, 51, 163.

[18] *Essai sur l'imagination créatrice* (1900), p. 93.

and representations, it contributes toward the formation of each state of consciousness and toward their association; in a word, it constitutes those general and momentary inclinations that are called attitudes."[19]

Thus beneath our states of consciousness there remains a kinesthetic portion which we are unable to apprehend directly since it is our sensibility that reveals our inner states to us and this sensibility is not free from all elements of knowledge. These elements and these motor mechanisms, which are not accompanied by consciousness, are the skeleton, as it were, the permanent element which remains when the consciousness withdraws. In them lies the possibility of an unconscious motor activity, for motor phenomena possess an inherent tendency to organize and solidify. They have a latent role apart from their effective role. It may be that they constitute that "unconscious" of which so much has been said, with the desire to present either an intellectualistic interpretation of it, or else a mystical one, by appealing, now to a subconsciousness, now to a superconsciousness which, according to Myers and William James, would appear to constitute "a link between the human and the divine." If we accept a highly plausible physiological hypothesis, the unconscious acts simply after the fashion of an "accumulator of energy." In certain circumstances, the unconscious activity comes up into the foreground, takes the place of consciousness, annihilates the life directed toward the exterior world, and shows itself as a power alien to the individual. According to this interpretation, motor activity is at the root of all creation, of mechanical invention, art and religion.[20] It accounts for the phenomenon of inspiration which it strips of its element of mystery, since it results from a dual interversion of the normal state. If the fundamental mechanism of functions

[19] *La vie inconsciente et les mouvements,* p. 41.

[20] *Imagination créatrice,* Chap. iii.

like attention, the will, creation, which are connected with movement, eludes us, that is because there enter into consciousness only the two extremes, the beginning and the end, and all the rest takes place in the realm of physiology.

And so a subterranean life exists, a dynamic unconscious,[21] which is "a latent state of activity, of incubation and of elaboration," and which regards motor activity as the background of mental activity.

* * *

Among the various movements of the body, the organic, motor, vasomotor and muscular reactions are accompanied by a particular psychological equivalent, the affective state. Under whatever form[22] it offers itself and whatever degree of complexity it reaches, this is nothing else than the representation of organic sensibility, the direct and immediate expression of vegetative life; it has its cause in cœnesthesia. True, this interpretation, manifest for the purpose in view and long ago formulated by Spinoza in a less strictly scientific fashion, has but recently been extended to the lower emotions, the necessary manifestations of life, by Lange and James. It may be carried to the higher emotions; for, however complex the social and personal elements which combine in their formation, these modes of affective life could not dispense with an organic support. And Ribot, after examining, in their relations with organic life, the primary emotions—fear, the tender emotion, the selfish emotion, the sexual emotion—endeavors to show that the feelings, regarded in their concrete form at the very mo-

[21] *Logique des sentiments* (1905), p. 79. Ribot mostly shows himself very reserved on the question of the unconscious and refuses to declare himself categorically on "this inexplicable problem and the semblances of explanations" which have been given of it. He contents himself with distinguishing between two acceptations of the term unconscious: the *static* unconscious, "comprising habits, memory and in general all organized knowledge," and the *dynamic* unconscious. Cf. *La vie inconsciente*, p. 55, and *Psychologie des sentiments* (1896), pp. 173-175.

[22] On the classifications of affective life, to which Ribot attributes only a methodological value, see *Logique des sentiments*, pp. 24 and 67, and *Essai sur les passions* (1907), pp. 1-7.

ment they are felt and experienced, are accompanied by physiological conditions. Thus, the religious emotion is closely connected with the instinct of preservation; the moral and intellectual emotions with physical modifications and disturbances; the esthetic emotion with the excitation of sensorial elements, as demonstrated by the contemporary German school.[23] The passions themselves, which are prolonged and intellectualized emotions that have so far eluded analysis by reason of their very complexity, must have physiological — perhaps even pathological — conditions which Ribot endeavors to suggest in his *Essai sur les passions*. And so all the modalities of the affective life are attributed to the organic or vegetative life, to nutrition, to the life of relation, and, more generally, to the preservation and development of the individual. As Spinoza had already set forth in a famous scholion of his *Ethics* (III. Prop. 9, Schol.), and subsequently Schopenhauer, we find tendency beneath desire, beneath "will." And tendency is no more than "the possibility, which becomes a reality, of acting in a certain direction and with a determined end in view. The internal and external sensations, which incite it to pass from a state of potentiality to one of action, are but occasional causes. The fundamental phenomenon is still a motor one, i.e., appetition, sensation, attraction, repulsion."[24]

Tendency, however, has two fronts, one facing the unconscious, the other facing the consciousness and illumined by pleasure and pain. Beneath this latter front it becomes a new factor in the psychological life of the individual, a result which may serve as a starting-point for some new work, either conscious or unconscious. The conscious affective state seems endowed with spontaneity and with a finality of its own similar to that kind of internal finality invoked by biologists, for "the individual as a purely affective

[23] *Psychologie des sentiments*, I, Ch. viii. [24] *Essai sur les passions*, p. 55.

being aims at one object alone, the satisfaction of his desires; and in the individual each special tendency aims at its own special end and good."[25] In whatever form it be, the affective life permeates the mental life.

At first, the affective states become one with sensation and perception, which, like them, are of primary formation. Afterward, however, they occur in the functions of secondary formation, the conservation and revival of images, the interplay of images, elementary logical associations and operations. They also work with the intellect, a function of adaptation to the physical environment which contributes to the preservation of the individual and which has long retained the practical and utilitarian character it had at first. Later on, in the mental functions of tertiary formation, a distinct scission takes place between the affective life and the intellectual life, and their differentiation culminates in an opposition and an antagonism: on the one hand, the logical processes become cleansed of every element of feeling; on the other, we have the will and the creative imagination established. The world of knowledge and the interior world have won their autonomy and are each living a life of their own.

In a certain number of monographs Ribot describes some of the stages of the affective life; he is inclined to prefer those in which the interior life is seen in a state of comparative purity. Stating the principle of the existence of purely affective states and the secondary nature of pleasure and pain as different expressions of one and the same fundamental rhythm of life, he attempts to prove the existence of an affective memory.[26] He shows the interior life, which is naturally anarchical, divided between "states which mutually impede, exclude, destroy one another."[27]

[25] *Psychologie des sentiments*, p. 410.

[26] *Psychologie des sentiments*, I, Ch. xi, and *Problèmes de psychologie affective* (1900), Ch. ii.

[27] *Logique des sentiments*, p. 15.

But if some vital need arises, there is agreement between all the tendencies connected with the principle of conservation. Desires, aversions, beliefs become the starting-point of pragmatical reasonings, indifferent both to truth and to contradiction, and tending only to rationalize instinct. This *logic of the feelings*, from which rational logic has gradually disentangled itself owing to the control of experience, to the progress of technics, to an ever closer adaptation of reasoning to the nature of things, remains side by side with rational logic, even in modern times. The conditions of life which created it, maintain it in being. And not only is there a logic of the feelings, there is even, for the man who thinks, an instinctive mode of adapting oneself to things: *intuition*. "This state (considered as a simple psychic fact and independent of the metaphysical inductions that have been drawn from it) consists in feeling rather than in knowing. Analogous to a sensation rather than to a perception, intuition resembles a sudden and confused divination which baffles rationalism."[28] That direct form of apprehension, of spontaneous adjustment, which is included in feelings of sympathy, indeed seems to prove that logical thought is but one of the forms of knowledge.

Besides those kinds of survival which have eluded the domain of logical thought there are more complex states, such as the *creative imagination*. Creation has partially affective origins. "All invention takes for granted a need, a desire, a tendency, an unsatisfied impulse, frequently a very unpleasant state of gestation. In esthetic creation, we find the emotional factor at the outset as the prime mover, and afterward connected with the various phases of creation as their accompaniment. But affective states become more and more the material of creation."[29] There are functions that have but very tardily attained their

[28] *Psychologie affective*, pp. 100, 101, pp. 115-177, and note on pp. 115, 116, 117 (Judd's passage dealing with intuition).

[29] *Imagination créatrice*, p. 27.

development "and which presuppose the preponderance of the interior life in the sentimental form, i.e., a very rich substratum of various and complex emotions, qualified to form combinations, oppositions and contrasts of every kind." The *affective creative imagination* combines purely affective states, "emotional abstracts," which have become released from past feelings, by virtue of a mechanism analogous to that of abstraction and generalization. Living a life of their own, they group themselves to form partial systematizations. In reverie or impressionism we see outlined embryonic affective creations. In religious mysticism, where love is the first cause of invention, the affective creations are accompanied by a state of enduring belief. In the art of the symbolists, whose mechanism Ribot analyzes with considerable acumen though disclaiming all thought of criticism or capacity for worthy judgment, "sensation dies away in emotion and the artist invests things with his own affective color," "things are replaced by the emotion of things." The artist then has to struggle "against the obstacle of verbal expression which is ill suited to him, which impedes him, and, by an instinctive or deliberate effort, attempts to conceal his methods from the (musical) type form." Not so much interpreting the thought as the feeling, he confers on words, by various processes, an emotive value. But the affective creative imagination reaches its type form only in musical creation. No doubt, in its modes of expression, musical creation is subordinate to mechanical invention and also to scientific invention; in its nature it reflects an inner life which has no further contact whatsoever with the world of knowledge; and it was not without a certain amount of reason that Schelling, Hegel and Schopenhauer regarded music as a liberation. Thus we have revealed the struggle of creative imagination to attain its independence, to free itself progressively from objective conditions until the time comes when emotion,

living its own distinctive life, obtains the mastery over the individual, or else spreads out over things, expands and becomes a kind of absolute.[30]

There is still, however, in the order of action, a state characterized by the preponderance of the inner life in the form of hierarchical coordination, already sketched in the phenomenon of spontaneous attention where interest and the play of tendencies determine our attitude: a state which consists of the voluntary act. A reaction peculiar to the individual, "adapted to very complex, very variable and very impermanent conditions, differing from one individual to another and from one moment to another in the same individual," volition presupposes the intervention of intellectual activity.[31] Considered, however, as a simple state of consciousness, it is a phenomenon of choice which amounts to the establishment of a relation of agreement between one tendency or several contradictory tendencies with the totality of the conscious, subconscious and unconscious states which at that very moment make up the person, the self. "The choice is always based on an affinity, an analogy of nature, an adaptation."[32] As a stage toward action, therefore, volition sets up a balance between present tendencies and permits of an orientation of the action which may be in conformity with our character and which may cause to translate itself into action that one of our tendencies which shows the greatest affinity with it. For the final reason of the choice lies in the character. And so, contrary to the opinion of the intellectualists who regard the volun-

[30] *Imagination créatrice,* III, Ch. ii. Cf. *Logique des sentiments,* Ch. iv, and *Psychologie des sentiments,* II, Ch. x.

[31] *Maladies de la volonté,* p. 26. "Intelligence being a correspondence, a continual adjusting of internal to external relations, and, in its highest form, a perfectly coordinate adjustment, the coordination of these states of consciousness implies that one of the movements which expresses them. When an object is chosen, it acts after the fashion of what the metaphysicians call a final cause: it carries with it the choice of the means adapted to attain to it. Consequently, adaptation is one result of the mechanism of mind."

[32] *Ibid.,* p. 27.

tary phenomenon as absolutely new and as the manifestation of a metaphysical principle of liberty, the will comes from below. "Volition is not an event coming from no one knows where; it drives its roots into the depths of the unconscious and beyond the individual into the species and the race. It comes not from above, but from below: it is a sublimation of the lower elements."[33] The study of mental diseases shows that its fluctuations and changes for the worse closely depend not only on the weakening of the motor power but also on the changes for the worse experienced by the personality. It is an affirmation, a hierarchical coordination which presupposes the momentary unity of the inner life, for "the outer unity of life is itself but the expression of the inner unity." It is a state in which ideas are placed at the service of passion, an increasingly complex coordination of tendencies. In consequence it contrasts with the normal conditions of the affective consciousness which presupposes perpetual change and discontinuity; in consequence it takes place very seldom, a sort of "lucky accident." Only from time to time does the individual free himself from automatism, from the habits, passions and imitations in which he is imprisoned, and in an act expresses complete adaptation to the inner conditions of life. The voluntary act is the one which best reflects the character and is the most perfect expression of the constitution and organism of the person.

Thus we find indicated the fundamental place held by the organism, the person and the character. In the order of action and in that of knowledge, in both the lower and the higher functions, we invariably find the element of the self in so far as it reacts, "an extremely complex product which heredity, physiological circumstances both before and after birth, education and experience have contributed

[33] *Maladies de la volonté*, p. 150.

to form."[34] To be complete, therefore, we must here reinstate the effects of civilization. Alongside of the depths of the individual self we find the social self. But Ribot, who in another connection recognizes the specificity of the social,[35] includes it in his studies—and that for the very reason of their biological trend—only as a secondary element, and contents himself with summarily indicating its role in the formation of the character, the constitution of the higher feelings, and the constitution of the voluntary attention which is no more than a "sociological phenomenon." The evolution of the mental faculties shows that the inner life is alike their origin and their goal. The inner world more and more completely adapts itself to outer environments for the needs of active life, knowledge is established and gradually the impersonal elements become weakened, the initial provocative conditions of action become simple technical means and fade away before a complete and unconditional affirmation, a free expansion of the inner life. The being is no longer satisfied with giving a personal stamp to its activity. It must still obey the suggestions of imaginary life and express a sort of absolute reality in which the self is reabsorbed, mystical ecstasy or musical creation.

III. RIBOT AND CONTEMPORARY THOUGHT.

Thus, if we release Ribot's work from the secondary problems and the hypotheses, the justifications of detail, the accessory aspects which constitute its purely technical part,

[34] *Maladies de la volonté*, p. 30.

[35] In Ribot we find a latent sociology even though he did not always clearly distinguish the arguments which affirm, from those which deny the specificity of the social, and showed too great confidence in Tarde's occasionally fantastic results. In *Psychologie des sentiments* (II, Ch. viii), however, dealing with moral and social feelings, he admits the existence of a tendency to live in society, the existence of a clan as one type of society, a social molecule, the existence of a gregarious society to which, along with Durkheim and in opposition to Espinas, he subordinates the family society. The specificity of the social is thus, to him, an idea in a germinal state. He distinguishes between animal and human societies and proves that the social tendency, which is their starting-point, is one product of the conditions of existence.

this appears to be its essential nature: a study of the inner life in its divers manifestations, scientific both in purpose and in fact, though involved in a latent metaphysics. Ribot has extracted from the inner life, which becomes the more fixed and abundant the more we pass from the lower to the higher forms, a working hypothesis that eludes criticism. In doing this, he disturbs the balance of psychological studies at a time when music is entering into the manners of the age, when symbolism is being contrasted with naturalism and color being substituted for design in the plastic arts. Certain aspects of his investigations may connect him with Destutt de Tracy, with Cabanis, with Laromiguière, with Maine de Biran and with Stendhal; all the same he indicates a new phase which it may be advisable for us to regard as the intervention of a period quite as much as the intervention of a mind. Before Ribot, the French psychologists had investigated the relations between organic and mental life and had determined, so far as the resources of biological science at that time permitted, the part played by organic inclinations in the whole of the mental life. Destutt de Tracy in his *Eléments d'idéologie* and his *Théorie de la volonté*, Cabanis in his *Rapports du physique et du moral de l'homme*, Maine de Biran in his dissertations on *Habitude* and on the *Décomposition de la pensée*, and Stendhal throughout his works, had all made a thorough examination of motility, sensibility and passion.[36] The scientific habits of their age, however, had instilled in them a concern for a precise and exact terminology. They undertook a critical examination of concepts. Their pre-

[36] Cabanis has already remarked in his *Rapports du physique et du moral de l'homme* (ed. 1824, 10th Mem., Vol. III, pp. 145, 146), that the analyst philosophers, from Condillac onward, remember only the impressions that come from without, to the detriment of internal impressions. Cf. *op. cit.*, 2d Mem., pp. 56, 93, § IV, § V, and *Premières déterminations de la sensibilité.*

On Maine de Biran see the learned studies of Victor Delbos in *Figures et doctrines de philosophes* (1918), and *Philosophie française* (1919); on Stendhal, the work of H. Delacroix, *Psychologie de Stendhal* (1919). On Destutt de Tracy, my own essay: "Psychologie et logique de Destutt de Tracy" in the *Revue philosophique*, December, 1917.

cautions, their verbal exactitude — which our contemporaries, obeying their intuition, regarded as nothing more than obscurity and barrenness—become all the more pronounced in proportion as the states of consciousness examined become more uncertain and less strictly determined; into the unconscious and the subconscious they mean to flash the light of intelligence. They are deeply attached to science, the working of the mind, the higher forms of mental activity. And so, whatever importance they attach to sensibility, they regard both the organic and the affective life as distinct from conscious life; in the order of time, they are primitive; in the order of values, they have but a secondary importance. Ribot, on the other hand, looks upon the notion of affective life as fundamental in the order of values.

Then a process of irradiation interrupts the dissociation of the concepts used in psychology. Since the principal distinction set up by Maine de Biran between "feeling" and the fact of "feeling oneself cognizant" disappears, the concept of consciousness grows dim, takes on a new meaning and becomes identified with the concept of sensibility. The concept of sensibility itself simultaneously covers organic manifestations and certain modalities of conscious life, thus confusing the biological acceptation and the usual psychological one. On the other hand, the concept of intelligence becomes void of all positive content. Thus Ribot cannot free himself from the limitations he originally imposed on his investigations, in a natural feeling of reaction against intellectualistic psychology. As emotion extends and permeates every aspect of conscious life, it becomes impossible for him to see distinctly the function of the mind: the uniting and concentrating of the life within us and the insuring of a communion and participation among men in higher forms of reality which do not recognize the individual as such and break up the narrow circle of instincts and

desires. Following in this the example given by Taine, he substitutes for function an abstract logical mechanism and then, if the latter is unproductive, he expresses astonishment.[37]

Hence the method which Ribot thinks evolutive is only retrogressive. Passing suddenly from the evolved forms of mental life to what we suppose to be primitive forms, and then combining these elements to attain to concrete reality, we remain the victims of verbal constructions that have no scientific character whatsoever. The state of "the primitive man" as described by Spencer and the English anthropologists, the likelihood of an original fusion between sensibility and intelligence, cannot be made arguments which entitle us to rob logical life of its own distinctive value and of the preeminence it has won in the course of mental evolution. However great the distinction between inferior societies and modern societies, sociological labors do not show that feeling is anterior to logic; they only prove the simultaneity of the two.[38] Speculation, too, which ventures beyond these observations, is powerless to explain the transition from animality to humanity, unless it simplifies the question extremely and regards idea as no more than a degradation of tendency. However it be, the identification of consciousness with the immediate feeling we have of ourselves and an ambiguous study of sensibility which is not counterbalanced by a parallel study of intelligence, may help to curb English associationism by the introduction of a dynamic point of view and introduce some clearness into the psychology of movements.

[37] Cf. *Evolution des idées générales.* On many points, Ribot would seem to have found a precursor in Taine. Cf. "M. Taine et sa psychologie" in *Revue philosophique,* 1877, p. 23. Like the latter, Ribot wholly accepts the results of ideological analysis concerning the mechanism of intelligence reduced to *abstraction* and *generalization.* This formal explanation then enables idea to be volatilized, as it were, and concept—whose social nature is thus disregarded—to be reduced to a simple motor scheme.

[38] Cf. Lévy-Bruhl, *Les fonctions mentales dans les sociétés inférieures,* I, Ch. ii, especially p. 113.

This, however, is at the cost of a certain obscuring of general psychology. And Ribot would seem to be undoing piecemeal the work of Auguste Comte and of Renouvier.

* * *

After this intrinsic examination, it is perhaps advisable to consider Ribot's work as it manifests itself.

His intellectual probity and clarity of exposition, his documentary wealth and largeness of view have won for Ribot a degree of legitimate authority both in France and abroad. After first concentrating attention on a domain totally new to generations brought up in the ignorance of the eighteenth century, he brought together the scattered efforts of alienists, doctors and physiologists, formulated problems, showed that clinical studies were a means and not an end, and supplied a technique and working hypotheses. In this respect, his efforts bear a certain analogy with those of Claude Bernard. Like this latter, he neglected ready-made science in order to consider more especially science in the making. Like him also, he attacked the scientific circles even more than the philosophers. His earlier works on the *Diseases of Memory, Personality and Will* have given birth to a school which has taken up the study of somnambulism, hysteria, psychasthenia, dual personality and mental alienation with the object of placing mental pathology on a firm basis.[39]

The pathological investigations, however, of which Ribot was the initiator, and which, as he readily acknowledged, characterized the school of French psychology, were in his mind and work only at the moment of his investigation. Sufficiently acute, even sufficiently artistic, not to limit sensible manifestations to organic manifestations alone, his criticism of symbolism and his excellent ideas

[39] Cf. Pierre Janet in the fine homage he pays to the "Œuvre psychologique de Ribot," *Journal de psychologie normale et pathologique*, July-August, 1915, pp. 276-279.

on music show what advantage may accrue to the psychologist from the study of artistic activity. Like Taine in the Preface of his *Intelligence,* he draws attention to the still unexplored domain of artistic creation, imaginary life and character. He opens out the path for new studies and his hidden influence may be seen in most of the works published in the course of the past twenty years.

Finally, while desirous of accomplishing a scientific work, Ribot attempted to dominate and transcend his age and to restore its independence to human thought. In order to judge of the great renown of his labors and of their claim on our gratitude, we must remember the situation in the world of thought previous to 1870. The artificial atmosphere, the lack of contact with popular forces, prevented these generations which Zola shows to be "stifled between the final convulsions of the Empire and the laborious parturition of the Republic" from uniting once more with a living past. Being of more recent birth, they have been forced to reconstruct the intellectual edifice. They have had the honest and rough labor, the audacity and the hesitation, of new men, of men who make themselves. Their work was first a feverish contact with European thought, a wide investigation, accumulated material and documents of every kind upon which the coordinating activity of the mind might subsequently work. And they confined themselves to the present owing to the fact that historic events had cut them off from human experience. Thanks to them, France was enabled to shake off the torpor of the Empire; organic needs were enabled to manifest themselves, the entire revolt of the inner life to merge into Bergson,[40] and the entire revolt of the social forces isolated from the Republic into Durkheim.[41] The generations also which were

[40] Cf. my essay: "Réflections sur le Bergsonisme," *Nouvelle revue française,* Dec., 1919.

[41] In my study on "Emile Durkheim, et la conscience moderne," *Mercure de France,* June 16, 1918, I have attempted to bring out this aspect, so essential,

indebted to them for the capacity of embracing wider perspectives, were enabled to repudiate them. They were dimly conscious of their disgrace, and nobly bore the burden of it. For they had divined the cost of scientific discipline to our civilization; they had made up their mind to reject cultural truths and embrace the truths by which a people lives; they knew they were not laboring in vain when they combined speculation with the criticism of morals. There is something touching, even painful, in the efforts whereby a Ribot, an Espinas "in the service of science" gave the best of themselves to bring about an intellectual renaissance in France.

For, if there is a certain ingratitude and lack of historic sense in forgetting services rendered, there may perhaps be an inexplicable dependence, a renunciation of all critical freedom, in the fact of hiding from ourselves the imperfections of their work. This is a work which must await its fruition and which will be fully effective only if it is transcended, if its secret intentions happen to be fulfilled; and justice will perhaps be rendered it by those who find in their very remoteness that recoil attitude so propitious for an impartial appreciation. They will desire a renaissance. And yet, in whichever direction we turn, belated systems of metaphysics, psychological and sociological disciplines: all leave behind the same lack of satisfaction. Everywhere the effort to attain to objective knowledge fails; everywhere organic attempts prove abortive. This is because men's minds are too deeply engrossed in the times in which they live not to feel the rebound of "that revolution which was wrought in human opinions and of the displacement effected in the relative value of things" and announced by Renan in 1866. The doctrine of evolution, of which they bear the stamp and against which they

in my opinion, to the understanding of the influences which produced Durkheim, and of the social ethics which was one of the most constant objects of his thought and teaching.

react, is but a philosophy of modern English industry and its technical innovations in which may be revealed a transformation in the economic estimate of intellectual values, a transformation which carries with it the momentary depreciation of intellectual life.

Now, events appear to be accelerating this struggle in which the future of civilization is at stake. From 1914 to 1919 human experience has been enriched by silent meditation born of human suffering, and we have discovered that a thought is judged by its power of expansion, its organizing value, its sufficiency from the human standpoint. We have learned that science, disinterested speculation, the forms of unactual thought, are mainly important owing to their ethical character. We are at the outset of a transformation in the moral estimate of human values, where types of humanity, instead of neutralizing one another, are opposed to one another. Perhaps we shall go so far as to seek in a sort of meditation, in looking back upon our civilization, for a truth by which we may be able to live and which expresses a profound agreement between ideas and morals. We shall then find in the very essence of French thought, in humanism, a wide and all-embracing inspiration, which will enable us to follow the tendency of modern societies toward an uncertain future, without sacrificing any of the requirements present at every moment of our history—requirements sufficiently complex to demand the mediation of thought, sufficiently vital for all speculation to be vain which does not first insure to them inner balance and social harmony. Then, fronting a state of chaos, France will uphold the rights and dignity of thought.

RAYMOND LENOIR.

PARIS, FRANCE.

LOGICAL FICTIONS.

III.

We have seen that the external world is known to us through patterns which appeal to us, as it were, by their flavor through our senses. We have to concentrate on selected bits of experience. And these bits are subjective in the sense that their form depends entirely on the nature of our comprehension, just as a drop separated from the ocean depends for its form on the "comprehension" of the atmosphere. We have also seen that, for practical purposes, this primary comprehension through the senses seems to be immediately modified by what we have called an explanation, the function of which is to satisfy, rather than to "explain" in the ordinary sense of that word. For instance, most of us are content to explain sounds by saying *where* they are, which does not say *what* they are. If, as was suggested, this satisfaction depends on the fufilment of expectations, it is important to see exactly how these expectations are formed. It is, of course, undeniable that many of our expectations are due, very largely, to emotions and passions. Even philosophers and scientists sometimes see only what they desire to see. But, however great may be the influence of emotion, we are not free, so long as we are sane, to see anything we fancy. The man in the moon is a fiction: the moon is a logical fiction. And it is the purpose of this chapter to explain the difference.

Most people would admit that there is something fictitious in "the space between two trees." A child can recognize such a thing: but if I sold it to you, it might tax the ingenuity of lawyers to decide what it was you bought. It is not hard to convince oneself that although it is easy to talk of a space between two trees, easy to "see" it, it is impossible to deal with it unless we take into consideration its limits. But it is clear that the limits themselves require to be limited before we can deal with them. A tree is a vague term which cannot serve as a clear limit, for it is as undefined as the space until we name the limits: and this can be done only by naming other limits, which also have to be defined by naming limits. Hence it is clear that when we speak of a thing, we are dealing with what may be obvious to a child (that is, what we have called the pattern); but this obvious thing depends entirely on definition, which is what we have called the explanation. Such obvious patterns as "life" and "death" are inconceivable apart from circumstances. If we keep clearly in mind that words not only are symbols for patterns, but also, *insofar as they have any meaning*, imply the defining circumstances as well, we shall see how it is that we can work so accurately and satisfactorily with what seem at first sight to be mere imaginations. It is true, in a sense, that the external world, as we know it, is a construction of our mind and exists, as such, only in us. But any statement we choose to make, provided that we can define the limits, may be true within those limits. We have seen that theoretically it is impossible to limit the limits: the process has no end. But in practice we can fix an arbitrary limit: we can (and must) afford to ignore the infinite remainder. Hence truth is always relative, but for practical purposes relative truth may be treated as if it were absolutely true. This is clearly a fiction, but it is as logical and useful and correct as the

differential calculus. We now have to consider what it is that makes a "logical fiction" logical.

We shall deal in a later chapter with words in combination, that is, the symbol, or expression, of a sentence. At present we are concerned only with one element of such a sentence, namely, such symbols as dog, doom, death, darkness and similar words. We have seen that children can use them: and that any fool can tell, for instance, what is darkness, but only a fool thinks he can say what darkness is. Now it is quite conceivable that a child might recognize one dog, but not two dogs: it might call one of the two a wolf. Thus what you would call two dogs, the child might call a dog and a wolf. Further knowledge, we say, will lead the child to call them two dogs. What is this "further knowledge"? We shall answer this more easily if we work backward. Before a child could say "That's a dog," it may have been able to say that's a "big one" or "a lovely one" or "an ugly one." In other words, we can imagine it being concerned with "ones" qualified by an epithet. Even when we grow up we always think in this way, though we abbreviate. "One" here means an instance of: it is the pattern. That is ONE, we think; we then add the adjective: that is a *lovely* one, that is a *doggy* one. Hence it seems that the obvious pattern we spoke of is really ONE, and the limits or circumstances really epithets. Every *thing* may be first thought of as ONE and then as a *thingy* one. I find it hard to say which of these two is the more astounding performance. For let it not be supposed that ONE is simple. When we are dealing with a dog, the difficulty of seeing the oneness is probably as great as the difficulty of seeing the dogginess. For here again, we are baffled by limits that do not end. For "one" is only an instance of oneness; and as we can none of us remember our efforts in very early childhood, it is extraordinarily difficult to imagine how the faculty is developed; but there can be no doubt that, speaking gen-

erally and roughly, during those early weeks an instinctive desire for rest and for a feeling of safety drives us to concentrate our attention on the more permanent aspects and obvious portions of our perplexing surroundings. It is highly probable that most of our early ONES are unsuccessful constructions; it is certain that many of them are. But however far we go back, it is impossible to imagine any time at which ONE could ever mean anything at all unless at the same time we had some notion as to what kind of a one it was. In other words, it seems impossible to think of any "one" without the explanation that satisfies. It seems, then, that we must answer the question as to the child's increasing knowledge which will lead from "one dog and one wolf" to the correct "two dogs," by saying that the child has got the oneness—there is no doubt that the animal is *one*, whether you call it a dog or a wolf—but that its epithet, its analysis of the circumstances, its idea of the duties to be expected, differs from yours. In other words, the child's taste differs from yours.

It has been said, in fact it is usually taken for granted, that about taste there can be no dispute. That is a preposterous assumption. Taste is the sole argument of all dispute. You admit perhaps that if I say "That is lovely" and you say "That is ugly," it is waste of time to argue. And yet if I say "That's a dog" and you say "That's a cat," ten to one you'll think that it is a matter of fact and by no means a matter of taste. Why? Because you assume in the second case that our taste in natural history is the generally accepted and orthodox taste, which, if once admitted, makes it impossible to mistake a cat for a dog; whereas in matters of esthetics, you are quite ready to believe that the circumstances, the limits, the relativity of my taste differs from yours. But if we can once agree as to what scale we are using to determine the ugliness or loveliness, just as we have agreed on a scale for the classi-

fication of animals, if we are once agreed as to the scale to be used, there can be no dispute. If we agree that loveliness is a matter of size, a whale is lovelier than a flea, but uglier than the world. If we agree that animals are four-legged, whales and men can't be animals, unless we find four legs in them. But it is clear (is it not?) that you can have no scale unless you use some other word: and a word stands for a pattern (including its circumstances). Hence we conclude that no word can be intelligible by itself: a word is and must be understood in terms of others.

This elementary truth is so disguised by common sense and habit that one hears the most astonishing statements as to what is meant (for instance) by "concrete and abstract nouns." We have all, possibly, had to learn this important piece of knowledge at school. We were solemnly told that we could "touch or see" a horse but not its goodness: most of us swallowed this absurdity. No one ought seriously to assert that we can see "horse" or "goodness": when we say we see a horse, we mean one horse or a horse ONE, just as we can see a big ONE, a white ONE or a good ONE. In all these cases we have the pattern defined or limited by the epithet. Just as that space was limited by being "between the two trees," so *that* (whatever it is) is defined or limited by words (expressed or understood) that give the point of view, or, as we prefer to call it, the scale. It is absurd to suppose that there is something extra important in the "horse" point of view. It may be the most common. To an artist the color may be far more important: and men who worship white elephants, white cats or white horses, clearly worship the whiteness and pay no more heed to the animal part than most of us to the age of animals or the number of eyelashes—both of which scales might be important to notice if they served any practical purpose.

We conclude therefore that whenever we use a word,

we are in fact dealing with a pattern which we think of as ONE, considered from a certain point of view. And instead of using such ridiculous terms as abstract and concrete, we shall recognize the following facts: (1) That all words considered separately *as words* express in some way the limits or qualifications of the ONE we have in mind—granted, of course, that it is practically impossible to define "word" in any satisfactory way, for if *mother-in-law* is one word, any sentence may be called one word, and if it isn't one word, why isn't it? (2) That in order to get meaning it is necessary always to deal with at least two words, one of which is ONE. (3) That when we are dealing with, let us say, ONE qualified by a word like *horse* (i. e., a horse or horsy ONE) or a word like *chestnut* (i. e., a chestnut horse), these words have meaning only insofar as they supply a scale.

A word like *horse* is a difficult scale, it will be better to deal with easier scales first. It sounds a paradox, but it is true, that in ordinary life most of us do not recognize common things like horses and cats by their horsiness or their catness, but by their shape or some other quite unreliable point, just as a peasant might recognize a whale as a fish because it lives in the sea. What we ought to mean by a horse and what we do, as a rule, mean, are different things; and this ambiguity would lead to confusion. A word like IT, though apparently more difficult, is not ambiguous in that way. When we ask ourselves what we mean by IT, we, with our Western education, probably come to some satisfying explanation by calling it a pronoun, disregarding the fact that languages get on very well without pronouns and that a pronoun of the third person ought not to be used impersonally or unpronominally. If we use it impersonally and say "It is raining" or "It is freezing," it is not at first sight easy to determine what "it" stands for. Even if we grant that it is equiva-

lent to a termination, so that we might just as well say *rainit,* we do not get away from the fact that it adds something to the meaning. Such a phrase as *"es gibt"* is translated "there is"; we can say "It is a dog" or "There is a dog." Or we might say "There's freezing" instead of "It's freezing." The phrases undoubtedly sound different: that may be a matter of habit. Is there any difference? We do not, of course, suggest that the word "it" is always equivalent to "there." Such a word as "it" may be used idiomatically: it may often have the meaning of some other word that it has come to replace—as all words may; or it may be used much like a diacritic; or it may have no more meaning than, for instance, the first, the inverted question-mark in Spanish. But if we limit our discussion, for the moment, to the way in which it is used when we say "It's freezing" and consider it side by side with such phrases as "We're freezing" of "They're freezing," we cannot fail to see that the actual meaning of "freezing" changes as we change the other words, just as the "space between two trees" will look different from different points of view. If we talk of freezing, as we do in all these sentences, we are not only concerned with the freezing but with the position of it. We are not necessarily anxious to put our finger exactly on the spot of view; but no one, if he is on the lookout for it, can fail to notice how in passing from one sentence to another—*We're freezing—They're freezing—It's freezing*—we do in fact move in space: and by this movement we are able to understand, sufficiently accurately, the "freezing" in terms of its position. Likewise if I say *I'm freezing—My fountain pen is freezing*—I have changed the position in space and thus changed my view of the freezing. We all know what is meant by blushing: notice how the idea adjusts itself as I move it in space—*I'm blushing* (there's blushing here), *he's blushing* (there's blushing there), *the sky's blushing*

(there's blushing in the sunset). In one sense it is the same blushing—otherwise it could not be described in one word; in another sense it is three different things: but the difference is not in the blushing but in the limits—that is, in the space scale.

Let us take one step further. A Frenchman says *il pleut* or *il plut*. Is it not clear that the distinction here adds a time scale? Thus we have "a rainy ONE" not only where? but when? When we say *he loves* or *he loved*, we have a loving there (i. e., in him) then or now. It sounds vague enough: but it is, in fact, so accurate that, if necessary, we could go on defining our meaning more and more precisely. We cannot, as we have seen, get the statement absolutely accurate: it is never possible to get to the end of the circumference of a circle. But relatively, that is, by taking our point of view, we can fix ourselves on the circle and thus measure the rest and find the relative measure; so with space and time we can pin down our ideas exactly enough, the moment the point of view is assumed. From a given point of view there can be no discussion: it is a matter of reckoning; whereas the choice of a point of view is a matter of taste. Thus if I am looking at a yellow flower, the "a" (or oneness) is an assumption: but given that, we can be interested in the color or the flower: in either case we are (if we mean anything at all) thinking of a scale which is implied by yellow or flower, namely an all-the-colors scale and an all-the-plants scale. If we add another epithet and think of bright yellow or small flower, we cannot understand these epithets unless we are thinking of all yellows or all flowers as scales on which we place, as accurately as need be, the individual instance we are considering. Go one step further—fairly bright, very small, and we have here to think of position on a scale of all the brights and all the smalls.

To return to the chestnut horse: if we are thinking of

the fact that it is a chestnut one, we clearly have a scale of all colors—this is, of all colors, chestnut. But if we are thinking of "horse," it is unlikely that any but a scientist would think of a horse scale. Few of us could explain the essential characteristics of horse. But we all have some idea of its form: and form is the outward and visible sign of movement, a special kind of which is known as growth. It is not possible to determine here how a horse is recognized by the majority. It is sufficient for our present purpose to suggest that, if it is the form that gives the scale, we have as a background and scale for our idea—all possible forms—and, that one which is a horsy one.

Be that as it may, it may help us to see more clearly how the scale works, if we consider the difference between *a kettle singing* and *a singing kettle*. Turning the phrase as before, we have two ONES; one is primarily a *kettle* ONE and the other a *singing* ONE; the next step gives us a singing kettle ONE and a kettle singing ONE. It is clear that, to start with, we have had a scale in the one case, of all possible pots and pans; in the other case, of all kinds of noises.

Hence it seems that in the use of words we are always implying that we are dealing with one particular position or part of a scale. We are always thinking of one with reference to all possible ones. Thus "a horse" means ONE particular spot called horse on a scale that includes all spots (let us say) on the animal scale. The moment I add another epithet I shift to another scale. If we think of the idea represented by a word as a circle, we can see the process more clearly. Horse is a circle which by itself is useless because, unless we select a point of view, we can wander round it forever and ever. But we know that all possible horses exist on this circumference: we speak of a black horse, and at once our circumference is divided into two parts—black and not black. In other words, all

possible horses, viewed in the light of a color scale, immediately range themselves. If we had taken the scale of size and spoken of a large horse, the horses would again arrange themselves into their own portions, large in one part, small in the other. If we combine the two we get the horses still more definitely arranged; and if we add a sufficient number of epithets we shall get what is usually called, to save time, by a "proper name," that is, as a rule, any name except the right name: thus you can call one horse Scepter, Prince, or X, anything, in fact, but horse.

Thus, we always have on the one hand, or, as the phrase is, at the back of our mind, a scale containing all possible ONES; we also have an instance which, insofar as our scale is a useful scale, must at once locate itself. It is as when we are thinking of the scale from 1 to 10, any intermediate ONE, say 5 or 7, at once locates itself, or of the scale of browns, from light to dark, any shade must at once fall into its own place.

It is suspected (except by certain modern soul-analyzers) that when we dream it is not the subconscious that is at work, but that, on the contrary, it is the superficial senses that are supplying matter while the subconscious is unable to scale them: it all seems to happen as in a fairy tale, "once upon a time there was"—and we are never told what time or where. There can be no doubt that we do get, even in dreams, some kind of logical scaling, just as we do when we are fully awake. But the whole realm of dreamland seems to be the fleeting product of those short moments when the senses are rather more awake than the other energy that "scales": this other energy being the cause of right thinking.

Perhaps a simple way of visualizing all this is to think of what happens when an airman is about to drop a bomb on a hostile city. We need not work it all out in detail: but it is clear that although the city far below is the reality,

it is, in fact, beyond his actual reach and, for practical purposes, his map is his reality, though it is man-made and nothing like reality, except insofar as it is a picture to scale. The map is a fiction: it is a logical fiction if it is to the required—that is, a convenient—scale.

[TO BE CONTINUED.]

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COSMIC PROCESSES.

INTRODUCTION.

THE recent advance of science has been due to rigid specialization. Fields of research have been definitely marked out within which each worker confines himself. The benefit of this method is apparent, but so are its limitations. Nature does not work in isolated apartments but through a unitary process all parts of which are interrelated. A scientist can hardly advance beyond routine investigation without crossing boundaries which science has erected. An economic problem is not solved until roots are bared which relate to geology and physics. Nor can a physician treat disease without a knowledge of chemistry and biology. In addition to this certain sciences have gained a prestige which enables careless thinkers to transfer the doctrines of these sciences over into those struggling for place, and thus to establish a pseudo-science which is little more than repeating the dogmas of one science in places where they do not fit. Much of what passes for deductive economics is merely trite analogies carried over from astronomy and physics. Deductive economics may be said to have arisen when the law of gravity and of the motion of heavenly bodies became a topic in popular education. What is the law of diminishing returns but a restatement of the doctrine of the dissipation of energy? What are the studies of race and personal traits found in sociology except crude deductions from sweeping formulas which biologists have imposed on world thought?

It is not a wanton urge to assault but the need of self-defense that has forced me as an economist into studies beyond my own field. A book on *The Degradation of Democratic Doctrine* by the late Henry Adams shows the handicap from which an economist suffers.

"Within the solar system there is a constant loss of energy."

"All nature's energies are slowly converting themselves into heat and vanishing into space."

"Any restoration of mechanical energy without more than equivalent dissipation is impossible."

"Within a finite time the earth must become unfit for the habitation of man."

Those are the propositions which popular writers dig out of physics to support their views. The universal use of these is shown in the criticism Mr. Salter makes on my recent article (*The Monist,* Jan., 1920, p. 146), where the views of Nietzsche are advanced to oppose my position. "Progressive evolution is limited. At some point disintegration sets in. Chaos returns and in time a process of evolution begins over again." This type of argument merely reflects the mood of the writer. A thousand others besides Nietzsche have argued in this way and reversed their constructive efforts when fancy dictated. There is no one place to throw the wrench into the machinery. It will always work destruction when a writer wants to slide back into chaos.

To alter these formulas does not demand new physical discoveries. So far as facts are concerned they may be found in any text-book. The change is in value and in logic. Some propositions taken from a supreme position are made over into corollaries. The logic of science has changed as science has gone through its epoch-making evolution, but the formulation of its doctrines has not undergone a like reconstruction. The laws of motion, the

law of gravitation and that of the conservation of energy belong to different epochs of scientific advance and harmonize neither in their premises nor in their logic. The old logic deduced its conclusions from dogmatic premises. They were therefore overstatements which gave universality to what was local. The new logic is equational. Until the sign of equality can be put between two series of facts no valid reasoning is possible. To predicate universality is to falsify. If this be true, science should start from the conservation of energy and restate the laws of gravity and motion in formulas which will make them subordinate to the great law of conservation. With the exclusion of psychic assumptions science gains its ultimate goal. It traces changes from form to form but never predicates loss or gain.

THE NEW PHYSICS.

Years ago I wrote an article on the above topic which I sent to a couple of scientific periodicals. One editor replied that he would not dare print it; the other indulged in so much sarcasm that I threw the paper aside. Of late changes in scientific attitude have arisen which arouse the hope that the obstacles to a broader discussion have been reduced. The doctrine of relativity has passed from the stage of a mere conjecture into that of a working hypothesis. Beside this the doctrine of an ultimate atom has been disproved by evidence all must heed. Atoms are not cold unchangeable objects but are active agents capable of dissolution and of an immense discharge of latent energy. These facts lead me to restate my thought strengthened as it has been by new facts.

The law of gravitation assumes that matter attracts matter and that masses move toward each other according to given rules. A second law is the radiation of energy. Energy tends to move apart and to be lost in the distant

recesses of space. Herbert Spencer states this as the integration of matter and the diffusion of energy. My question is: How would it do to turn these two propositions around and say that energy tends to concentrate while matter tends to diffuse itself? If masses of matter and energy move toward each other, does matter carry energy with it as it gravitates, or is energy the propelling force carrying matter along as it unites into larger units? It can easily be seen that matter and energy both aggregate and diffuse themselves, but which is the primary tendency and what are the laws that regulate this tendency? Will not the facts support one statement as well as the other? And where do differences appear by which the two statements can be tested?

It is not necessary to restate the arguments which lie back of the laws of motion as modern science correlates them. As ordinarily stated, energy takes two forms, the energy of motion and the energy of position. According to the law of the conservation of energy the gain of the one means a loss in the other. To call this second form the energy of position does not fully state the facts. The newer knowledge indicates that what seems mere position is not a state of rest but a transformation of linear energy into axillary energy. In harmony with this I assume that the two forms of energy are linear and axillary and that the losses and gains of the one have their exact equivalent in the opposite change of the other. When bodies move toward each other there is a loss of axillary energy and a gain of linear energy. When they move apart axillary energy gains at the expense of linear energy.

How linear energy acts is illustrated in the case of gases which are held together by a commanding attraction. The movements of single particles in this case are not orderly but in every direction, making collisions frequent and inevitable. Of this disorderly state there are three

indices, heat, linear movement and friction. Where one of these is manifest the others are always found. In contrast to these, orderly movements are axillary because they are the only ones among which collision, friction and generation of heat can be prevented. From familiar laws of motion discordant movements in a gaseous body will have selective results. A part of the particles will form orderly ellipses and the rest will be thrown into outer space. All cosmic bodies are of this sort. They may be too small to be visible or as large as the greatest planet, but insofar as they are orderly they are motion- and heat-losing bodies.

Such an analysis contains nothing startling. It might readily be deduced from the received laws of motion and matter. The break comes when the question is asked: Is gravitation like heat and motion subject to counteracting influences, or is it an unconditional force in its manifestation above and beyond all restraint? To say that gravitation is conditioned in its manifestation like heat and motion does not mean to deny the law of gravitation as applied to terrestrial affairs. It means, however, that our gravitational force is true only of bodies of like size, heat and motion. Larger and hotter bodies would have more than proportional gravitational force while colder bodies would have it correspondingly reduced. The degradation of gravitation from an absolute to a relative law would not alter the world as we know it, but other heavenly bodies would have to have their weight, size and motion determined not by absolute standards but by those which are relative.

The accepted statement of physical laws is due to the earlier recognition of the laws of motion rather than of the conservation of energy. It is this which gives the laws of motion their absolute form, psychic predicates being intermingled with objective fact. To avoid this confusion, the laws of motion should not be accepted as original data but

so transformed that they become a consequence of the conservation of energy. The fundamental facts relate not to the laws of motion nor to gravitation but to energy which is the cause of motion and gravitation. Starting from the conservation of energy as a fundamental datum, the first deduction should be that when two bodies come into the same energy-field, that is, when they attract each other, kinetic energy aroused in each is equal, no matter what their size or position. The energy which A expends in moving toward B is the same as the energy B expends in moving toward A. Any other formulation would mean an increase or decrease in the total energy of the universe. A stated fund of energy is thus transformed into motion, and each body, no matter how great or small, has to transform into kinetic energy the same total amount of energy that its opponent does. But while total energy expended is the same, the amount of motion varies with the mass. This again is a deduction. A body one tenth the size of another must move ten times the distance to keep the expenditure of energy the same. This simple law holds so long as bodies move through empty space; but as they approach resistance arises in the form of pressure. This resistance which blocks motion must in its force be equal to the force exerted by the approaching body. The energy of resistance is thus the energy of attraction in a new form. The pressure at any point is equal to the resisted movement at that point. The pressure at any point must therefore equal all the resisted movement which would pass through this point. If so, pressure must vary inversely with the distance from the center of gravity. The surface of a sphere of half the size has a fourth the surface of one double the size. Through each point of the surface of the inner sphere four times the movement must take place as on the corresponding points of the outward sphere. If the pressure at this half-way surface is four times as great

the compression at this point would be four times greater and the friction would be increased fourfold. This statement assumes an axillary motion increased by the compression. If this is true the electricity generated by friction at the surface of the inner sphere would be four times greater than at similar points on the outer sphere. As a result of this higher potential a stress would be created tending to move the electricity outward to points of lower potential. An ingoing body would thus have its movement accelerated by a speed equal to that of the outgoing electric current.

Without attempting to prove my point, is not the fact this? The acceleration of speed by which an unsupported body moves inward is that which would result if the opposition in front were removed. The forward movement is that of a rear pressure unobstructed by front resistance. To explain may be difficult, but the fact is worthy of note and should put the student on the track of the needed explanation. That repulsion can be transformed into attraction is shown by electrical phenomena. Doubtless there is some connection even if the cause is obscure. Physics should deal with facts rather than with causes.

A solution of this problem can be attained by combining the wave theory which Newton rejected with his demonstration of gravity. The wave theory assumes that a partial vacuum exists on one side of the moving wave at the moment when an increased pressure occurs on the other. A shift then takes place reversing the point of pressure and the position of the vacuum, the pressure and the vacuum being each in turn before and behind the line of the moving wave. Newton assumes that a falling body moves a slight distance at a uniform speed and then suddenly increases its speed for another period. There are thus formed a series of steps of increasing speed instead of a uniform curve. If this assumption be so modified

that the falling body moves this infinitesimal distance at a uniform speed and then strikes a resisting body a wave would be formed among the particles of the resisting body. This would make a compression before the falling body which a moment later would be turned into a vacuum, the pressure now being on the rear of the falling body instead of being in front of it. If the falling body halts a moment at the end of each step before going on to the next, it would have a vacuum ahead of it and a pressure behind it, giving a reason for the increased speed. Adding to Newton's supposition a momentary pause at the end of each step would thus bring his proof in harmony with the supposition I am using. What is needed is a transfer of pressure from before to behind the falling body, and however done the result would confirm the Newtonian reasoning.

My main point has, I hope, now been made clear. There is a difference between the attraction of two bodies and the acceleration which takes place as the bodies approach. Attraction is a constant force. Acceleration is a local force due to the increase of pressure. Acceleration is thus not a primary force as the Newtonian law predicates, but is the result of an electrical disturbance. Pressure creates friction and friction generates electricity. It is often stated that the laws of electrical movement are the same as those of gravity, with the important exception that electricity sometimes attracts and sometimes repulses. If when they both work together the gross result is that which either force is said to create when alone, why cumber the law of gravity with an accelerating force which electricity would create? We only need to see what happens when the two forces oppose each other, to discover which is the part each agent plays when they act in conjunction.

A decision must also be made as to whether electrical units are different from other kinetic units, or whether they are kinetic units under special conditions. How can

units which attract be transformed into units that repulse? The reply is that units which normally attract repulse each other when under pressure. When two bodies with the same axillary motion collide they will repulse each other because at the point of contact their axillary movement is in opposite directions. When the movement at the point of contact is in the same direction the current of each is transferred to the circuit of the other, making a figure eight with a circuit double the length of either element. In this way pressure is reduced and the equilibrium of momentum restored. Pressure reducing the length of each circuit disturbs the equilibrium of momentum. The tendency to conserve the momentum would thus force the entanglement of the circuit when a similarity of movement permitted. In this way an opposition between like bodies would result in repulsion, while bodies with dissimilar motion would attract each other. Like thus repulses like and blends with its opposite. This is the fundamental law of electricity reflecting a state which is sure to arise if bodies with axillary motion are put under pressure. The increase of electrical tension would be the same as the increase of pressure. The total speed of bodies without support would thus be the sum of attraction plus that of acceleration.

Acceleration and attraction are thus due to different causes though intimately associated. Pressure is resisted attraction, not an independent force. As soon as bodies enter a pressure-field, the secondary laws of motion begin to exert their influence reversing or augmenting the primary tendency to approach. Compression, heat, friction and electricity are each a manifestation of pressure and grow in importance with the increase of pressure. Together they make the acosmic forces which tear down the cosmic order. To create cosmic stability these antagonistic forces must be thwarted. The main agent in this work is an inverse acceleration by which discordant motions are

thrown beyond the influence of the cosmic bodies. When collision occurs there is not a dead uniformity in the reaction in which each particle receives the same reverse motion. The conservation of energy calls for an equality between the forward and the reverse motion, but it does not demand a similarity in individual cases. There can thus be a concentration of the reaction in the light particles which would give them a speed throwing them beyond the influence of the bodies in collision. Discordant forces would thus be eliminated and the stability of cosmic bodies maintained in spite of opposing tendencies, which, concentrating themselves as heat and light, are dissipated in space. Every disturbing force can thus be resolved into parts, some of which will blend with those making for stability while the lawless elements are concentrated, accelerated and cast into outer regions where they can do no harm. Pressure and its resultant forces are thus transformed into an ingoing acceleration which creates collision, and then into a new resolution of forces a part of which become cosmic while the rest is ejected.

The principle for which I contend is the transfer of velocity from heavy to light particles when collision occurs. This is a fact shown by the act of gases in collision. The higher motion attained by certain particles would not be acquired but by some transfer of velocity. Collision is thus the cause of light bodies moving beyond the sphere of influence of controlling central bodies. In these distant parts what seems absolute on the earth would become relative since what to us is dominant would then be weak or recessive. Contending force would tend toward equality and could more easily be reversed.

THE ORIGIN OF PHYSICAL CONCEPTS.

If human beings remembered the stages of their thought development in acquiring the concepts needed for external

adjustment the errors into which they fall could be avoided. But no one can recall the beginning of his thought nor the order in which his concepts arose. He is compelled by his relations to others to acquire their language, views and explanations from which at maturity he frees himself as best he can. Revolutions come, but they are not thorough. They usually relate to the latter stages of human development and thus leave underlying concepts unaltered. Only an abstract method can clarify these initial stages and rearrange mature thought in harmony with its natural order.

Physics, like every science, suffers from the lack of such a rearrangement. It still accepts certain primitive notions as fundamental and has not recognized the difference between popular psychology on which its foundations rest and the superstructure which is the outcome of observed fact. Physics should be an objective science, but it cannot be until its psychic presuppositions are separated from facts and principles which reflect the actual order of nature. Only when the psychological problems of physics are recognized as psychology can physics become a strictly objective science.

To make this analysis demands a restatement of familiar facts and the predication of a new order in which physical concepts arose. The ultimates of consciousness are in terms of intensity, movement and color. We do not see things, we see motion. Neither do we see space. We develop the idea of space to explain the movements we see. Instead, therefore, of space being an original concept, it is something we build and in the building has gone through many stages. Nor can we see motion directly. Were there but one body in the field of vision we could see its color but not its form or motion. We need two bodies to see movement and two, if not more, to see form. What we call two-dimensional or plane geometry relates to the movement of bodies in a single plane, but we would not know what

a plane meant if we did not have bodies whose movement could not be accounted for on the assumption that all bodies move in a single plane. We increase the number of dimensions to account for facts which do not accord with simpler assumptions. We sometimes hear it said that a fourth dimension is a mere assumption, differing therefore from the three dimensions which language and custom have made familiar. But a fourth dimension has no other basis than that on which three or even two dimensions rest. They are no more objects of observation than it. The problem is: Can the movements of which we are aware be accounted for in a three-dimensional space, or must we enlarge our conception of space to bring popular concepts in harmony with facts?

It is evident that recently acquired knowledge creates a situation which our antecedent physical laws explain with difficulty. Either the accepted laws of motion must be modified or our concept of space must be enlarged. At bottom, however, the two mean the same. To say that space is warped predicates that motion is not on straight lines; in a warped space all movement would be curved. It involves a contradiction therefore for a person to say that he holds strictly to the Newtonian laws of motion and yet believes in non-Euclidean geometry. Our space-concepts are not independent entities. They are pictures we create to account for movement. If to explain motion non-Euclidean geometry must be used, then movement must be primarily along curved lines as they are defined by Euclid, or at least it must be curved on some of the planes in which movement takes place. No space-concept is directly given by the senses. Motion is thus given. Space must therefore adjust itself to motion, not motion to space.

In harmony with this thought I assume that if a warped space is necessary to account for motion in some dimension movement must be curved. If this is not true in a space of

three dimensions, then a fourth dimension is necessary. But before this decision is accepted a reexamination of the laws of motion should be made to see if they cannot be reformulated so as to make movement conform to the demands of space as we now conceive it. A new formulation of the laws of motion must begin, not with assumed sense-perceptions such as straights, planes, solids and the like, but with measurable objective facts by means of which psychic predicates are eliminated. The mixture of subjective and objective concepts should always be avoided and this has not been done in the laws of motion to which Newton's name is attached.

A clearly defined objective standard can be obtained only by the use of the law of the conservation of energy. Motion must conform to it and not it to the psychic predicates of motion. Can objects move straight as psychically defined and yet be conserved? In some way movement must return to itself if energy is conserved, and if so, there is some defect in the psychic predicates about motion. We should therefore begin with the conservation of energy—an objective fact—and see from it and its corollaries what is the error in our psychic predicates. We thus obtain facts in harmony with, or derivable from, the conservation of energy.

1. No body can alter its position in space without altering the position of other bodies.

2. Energy tends to concentrate, as a result of which bodies move toward each other.

3. Energy is conserved.

4. Momentum is conserved.

5. Speed is conserved. Any transformation by which speed is lost is compensated for by another by which speed is gained. If it were once ascertained what is the average speed of all bodies in space that average could not be departed from. In its application this is a broader generaliza-

tion than the law of motion which affirms that action and reaction are equal. The difference is that the later statement is based on sense-perceptions of the action of colliding solids. Here each particle reacts as a part of a solid mass and not as an individual unit. There can thus be no acceleration or loss of speed on the part of single units. This rigidity applies only to solids. In other forms of matter the acceleration and retardation of molecules is conditioned only by the fact that no net gain or loss of speed can take place.

All motion is a change of position of one body in its relation to others. There is no absolute motion nor any absolute rest. The first law of motion is therefore an overstatement. There is no body at rest nor any body moving in a straight line uninfluenced by other bodies. If it moves, some other body is in motion. Every motion is a relation between two moving bodies. The net change is that from which psychic predicates of space are derived We see the motion and infer a plane in which the movement takes place. Space, straight lines, planes and solids are thus not entities but inferences by which observed motions are explained.

So long as but two bodies are within the field of consciousness the relations between the two are expressible in terms of straight lines and their movements are within a single plane. Two-dimensional space is thus observable and from it we derive our notions of other forms of space. We make three-dimensional space by combining three two-dimensional planes and thus give to the enlarged notions of space the same attributes which have been affirmed of two-dimensional planes. It is, however, questionable if three-dimensional bodies are made of planes which fit in the manner Euclidean space predicates. If some of these planes are warped, then a movement in this plane would be curved.

The question I raise is this: If two-dimensional planes were united to form a three-dimensional body, would not some of the planes have to be warped to make them fit into their new position? Is, in other words, psychic straightness seen in two-dimensional relations the same as the straightness of three-dimensional bodies? Or, again, are not three-dimensional bodies non-Euclidean in their relation to two-dimensional bodies? It seems to me that there is no difference in saying that the space in which bodies move is warped—a deduction of non-Euclidean geometry —and saying that the planes of two-dimensional bodies and those of three dimensions do not exactly fit. Straightness for the one is not straightness as measured by the other. The difference is that in one case we are talking in terms of objective relations, while in the other we are using terms derived from ideas constructed to explain these objective relations. The dimensions of bodies are reals; the space they occupy is a mental construction.

This thought that the dimensions of bodies do not fit leads to the thought that bodies we assume to be solid are not solid but a a group of movements in different planes. What we call solid is merely pressure coupled with a feeling of muscular resistance. If we cannot compress, or if a body seems at rest, we call it solid and affirm that two bodies cannot occupy the same space. Yet the facts directly given do not warrant such a conclusion. If what seems solid is in reality a group of moving planes, then another body could go through this body if its movements were in one plane and thus could avoid the planes occupied by the first body. All bodies are thus resolved into two-dimensional bodies moving in diverse planes. Combine them and we get three-dimensional bodies, and there could be four-dimensional bodies or bodies of any number of dimensions if they were needed to explain observed movements. Yet there would be no exclusion between these dimensions.

A two-dimensional body could move through a three-dimensional body, and a three-dimensional body could move through the area of a four-dimensional body. Ether, if it exists, is four-dimensional since three-dimensional bodies can move through it. All that bodies of a higher dimension can do is to twist bodies going through them out of their natural plane since these bodies must avoid occupied planes.

If this be true the dimensions of bodies have not those fixed relations which go along with our concept of solids. What psychically we regard as solid is really a number of interlocking planes each of which has its diverging movements and tendencies. The dimensions are therefore not perfect according to Euclidean standards, but alter and twist as the conditions external to them vary. There are one-dimensional tendencies, two- and three-dimensional tendencies, each being in a measure antagonistic. Pressure is two-dimensional and any reaction of pressure causes a divergence of the interlocking planes and thus strengthens three-dimensional tendencies. Pressure forces bodies to occupy less space and thus forces the planes of a body more into parallel positions. Take off the pressure and the three-dimensional tendencies are restored. We cannot say that a body is ever completely in any of these forms since by the influence of opposing bodies some of its planes would be distorted. The same definition of straightness would not apply to all of them and hence the movement in some of the planes would be non-Euclidean.

The essence of this thought is that bodies not only exert an influence on the movement of other bodies—attraction and repulsion—but they also exert an influence on the form of other bodies. Every body, we may say, has a dimensional influence on every other body in the universe.

Another way of viewing this law, or perhaps a modi-

fication of it, is the influence which in animal life is called tropic. A current passed through the body of an insect twists it into a curve. This would indicate that traverse currents bend the bodies through which they pass, which if it were a universal tendency would cause each body in the universe to exert some influence on the form of every other body. There would then not only be action and reaction between bodies due to attraction and collision but a tropic reshaping influence which would determine the line along which bodies move. Just as an insect bends out of a straight line in its motions when under tropic attraction, so every body bends a little under the influence of its neighbors. Nothing would move quite straight according to Euclid except an isolated body, and it would not move at all.

The assumption on which I have gone in making these deductions is that the conservation of energy is the primary force and that all movement is conditioned by it. Thought is thus made objective and increased in its universality. It shows that psychic predicates about motion and space either are not true or they are not universal in their application. Space, as we conceive it, is a relation between bodies and not a statement about the composition of bodies. We get our ideas of planes from these inter-body relations and then assume an exact correspondence between these conceived relations and the bodies themselves. We arrive at the concept of a non-Euclidean space as soon as we transfer our attention from the space that bodies are supposed to occupy, to the movements which bodies make. Then we have to conclude that either space in some of its parts is warped, or that the bodies in it are warped in their planes.

These facts are put in a more concrete form when we recognize the influence which pressure exerts. Around the great centers of concentrated energy pressure creates

cosmic relations. Outside of these pressure areas the acosmic tendencies dominate. We should not think, therefore, of particles moving out from these energy centers and being lost because the straightness of their movement isolates them from other bodies. The influence of each body on others is never lost. The interactions in outer space are the same as within pressure areas. But the movements and interactions give confused results. Bodies bend, twist and turn, but do not establish fixed relations of the sort a cosmic world reveals. The problem then is not one of losing energy. No energy or relation of energy is lost. What we need to discover is how this acosmic confusion is transformed into cosmic worlds. If order cannot be established and other worlds built, the practical result is the same even if the theoretic position is altered. Old worlds do decay. They lose energy. There would soon be a cosmic blank if order were not restored. We have shown what is the process by which the losses occur. Perhaps the same forces which destroy order can in the end restore it.

THE EVOLUTION OF COSMIC ORDER.

The scheme I have outlined does not differ from accepted views as to disintegrating forces which destroy cosmic bodies. Heat and light are lost with the result that the central body cools, contracts and loses its luminosity. If gravity is the result of a constant force due to attraction and an acceleration is due to increasing pressure, then the loss of heat and light reduces pressure and with it the element of acceleration in gravitation will fall off. The ejected elements are elements discordant to the cosmic order. Each gain in order indicates a loss in substance, pressure and friction. Cosmic bodies would thus become cold bodies with less cohesive power. They would exert less influence on hot bodies while hot bodies would exert a greater influence on them. Hot bodies would thus pull

cold bodies asunder or at least warp them to a greater degree. In addition to this the reduction of gravity would affect the outer parts of a body earlier than the inner. The pressure would thus be taken off the interior mass which by expansion would crack the surface parts. The net result would be that cold bodies would break apart and float off as discrete masses, each of which would continually redivide until a wide dispersion through space occurred.

This dissolution presents a different picture from that of the accepted view. Cold bodies hold together if gravitation is an absolute quantity. The one plan would thus assume the existence of large dark worlds plunging heedlessly through space at tremendous speed, while the other would have the same cold matter dispersed moving at a slow rate until it was absorbed into some new solar system by drifting into its sphere of influence. It cannot be said with certainty that there are immense cold bodies dashing through space. To meet such a body would end all life in a hurry. But it can be said that there are multitudes of small cold bodies drifting aimlessly about. The earth comes in contact with them daily. The presence of numerous asteroids in one portion of the solar system indicates that one planet has already broken up. Mars seems to be going the same way if what has seemed to be canals are really cracks in her surface. This would be a confirmation of the belief that cold bodies lose some of their specific gravity.

This explanation is at best partial. If nature is composed of orderly processes the loss of matter or motion due to the ejection of particles must be accounted for as well as the drift of cold matter which finally is reabsorbed in the active solar bodies. There must be some way to bring back into organic unity the ejected hot particles whose loss if permanent would drain the universe of its energy. This

is not an impossible task if the laws of motion as well as the force of gravity are relative. To get this new viewpoint we must assume that the ejected particles will as they move transform their energy from linear to axillary energy and thus cooling off would slow down as they move away from the ejecting body. In the end they would become cold bodies and be subjected to the laws applicable to cold planetary bodies. If a planet revolves about a sun or a moon about a planet there could be no change in the moment of momentum, but the tidal stress would slow down the revolutions until there would be one revolution of the cold body about its axis with each revolution about the sun. This is the inevitable result of tidal stress as is shown in the case of the moon and the lesser planets. Such is the fate of every cold body. Its momentum does not force it to move in a straight line but compels it to move about some hot body with its heavy side toward the heat. Microcosms are subject to the same laws as are planets and suns. They would therefore keep their momentum but curve about some central body. The gravitational force of hot bodies on the cold may be slight in the distant parts of the universe, but however slight it would produce inevitable results. The cold body always becomes a satellite of its hot neighbor. There would thus be a current of cold atoms about every hot body, and the universe itself would have an external ring in which even the lightest bodies would become entangled. If a particle was carried by its momentum beyond the influence of any particular sun the joint effect of all the suns would have a unified effect as soon as the bounds of the visible universe were crossed.

There would then arise a simple situation. The ejective force which came from some earlier collision or compression would be set against the combined pull of all the suns. Both forces would be on a decline but the ejective force

would fall off more rapidly than the force of gravity. At length the particle would come to the peripheral plane where the two forces were equal. The net result would be a movement along the peripheral plane with the heavy side of the particle turned inward toward the center of gravity. Assuming such a peripheral current to be started, the consequences would soon become apparent. The radiation-pressure would be a constant force since the quantity of radiation for the whole universe would be fixed. Gravity, however, would increase as the quantity of matter in the peripheral plane is augmented by new arrivals. The peripheral current would thus gradually contract and move within the peripheral plane. If so, particles would arrive at the plane of the current with some ejective force still active. The result would be that the bodies in the plane would increase their momentum through the ensuing collisions. A part of the ejective force would thus be absorbed in the primal peripheral circuit, but another part would rebound in the opposite direction creating an outer secondary current in the opposite direction. No matter in what direction a particle entered the plane nor with what force, it would finally be resolved into two forces going in opposite directions. Heavy particles would remain within and move with the inner current while the lighter ones would be absorbed in the outer current.

There would thus be stable cosmic conditions in this outer zone with no heat, no pressure and no friction. It is this orderly condition which should give us the picture of what happens wherever cosmic forces dominate. There would be a discordant center where cosmic forces never are in complete control, but there would also be two rings moving in opposite directions at the peripheral plane. Friction, collision and pressure may destroy the simplicity of the process, but every cosmic body tends to shape itself in this way.

If this is true we only have to watch the process through its next stages to see how the acosmic forces again come into play and thus compel the evolution of solar systems. Each addition of matter to the peripheral currents tends to draw them nearer to the central bodies and increase their speed. But the moment of momentum will not permit this contraction. The same distance must be traversed in each circuit as before. To do this, the currents must as they contract in their circumference increase their sinuosity. This would cause pressure, distortion and displacement. Heat would be generated and the attractive force increased not only in regard to central bodies but of the peripheral particles on each other. The result would be increased torsion; knots would be formed and then spirals. The mass would thus be thrown into the form in which the solar nebulæ are known to exist, the subsequent transformation of which into suns and planets is readily explained according to familiar laws. The cosmic process thus has two phases, in one of which heat, collision, pressure and friction increase. In the other these acosmic forces decrease and the simple cosmic tendencies prevail. A solar system runs down as it gives off heat. It revives as its particles are brought into order at the peripheral plane. A repeating order of events is thus secured. Each cosmic event has its antecedent and its consequent which in turn becomes the antecedent of the next step. There is thus no beginning nor end. Every step is so orderly that no need remains for the accidents, collisions, explosions, etc., on which the older scheme of the universe depended.

THE MOVEMENT OF SATELLITES.

The thought of the preceding section may need a supplement to make its bearing clear. The ejected elements must be traced and their return vouchsafed before a rounded system for the universe can be predicated. If the

conservation of energy is the ultimate law the ejected bodies have no energy except that derived from the parent body. Attraction creates pressure, pressure necessitates collision and in collision the discordant elements are ejected. But in being ejected they do not lose their ultimate relation to the parent body. They become satellites, if this word will bear an extension of meaning so as to include all ejected bodies which do not immediately through gravitation return to their source. Satellites are defined as bodies revolving about a central body. If ejected bodies become satellites the two can readily be designated by one term.

To prove their identity demands not enunciation of a new principle but merely a deductive application of what has already been shown. The central body from which the ejected elements arose moves with a high speed. If a particle is cast off at an angle from the motion of the parent body the attraction of the latter will not be an exactly opposing force to the movement of the ejected body, as would be the case if the parent body was stationary. Its movement makes the line of attraction an oblique angle instead of a perpendicular. The ejected body would swerve from its initial path in the direction taken by the parent body. It would thus move in a curve instead of a straight line which in the end would become parallel to the movement of the parent body. To see what would happen the acceleration of each body must be isolated from the attractive force which each body exerts on the other. Acceleration is the momentum derived from some earlier opposition of primary forces. This acceleration must be much more powerful than the primary attraction to create the curve described. Not only must its acceleration dominate over attraction but its acceleration must be greater than that of the parent body. It is then thrown ahead of the parent body and becomes a satellite by revolving about

the central body instead of returning to it. Every expelled body thus comes under one of three heads. If the attraction is greater than the acceleration it returns to the central body. If its acceleration is less than that of the central body a return can also be predicated. In the third case, where the acceleration exceeds that of both the primary attraction and the acceleration of the parent body, a satellite is formed which revolves about, instead of returning to, the place of its origin. Any ejected body must return to the parent body, become a satellite or be thrown so far away that it comes under the influence of some other solar system.

Given these facts, still another predicate is possible. Every moving body or aggregate of moving bodies has a medial plane along which the aggregate movement takes place. This plane must average the opposing forces and of the diverging tendencies have as much on one side as on the other. The discordant tendencies will accelerate the movement of particular bodies by side movements which as soon as they begin will be thwarted by dominant tendencies of the parent body. Particular bodies will therefore curve in their movement and be transformed into satellites, or through attraction return to the parent body. Side movements, although perpetually recurring, are temporary in their effects and have no influence on the medial plane along which the parent body is moving. Any solar system tends to become a moving disk, narrow on its sides but greatly extended along its medial line. Gradually opposing side movenents will wear themselves out and each minor body will have a medial plane parallel to that of the parent body. The attraction of the central body will also slow down, by tidal stress, the revolutions of each satellite until it revolves on its axis but once with each revolution about the central body. The victory of cosmic forces in any solar system would mean the formation of a narrow

linear plane with all minor movements in exact conformity with the medial plane of the whole system.

Extending this thought to the whole universe, there would arise for it a medial plane along which the various solar systems would tend to group themselves. The universe would thus become a narrow disk opposing movements within which would tend to equate each other. Such seems to be the case, as indicated by the Milky Way, in which the great mass of stars seem to be. Not only the stars but all planetary bodies seem to be controlled by these major tendencies. Order dominates in the end through the ejection of discordant forces and their reaggregation in new cosmic forms.

To this medial plane the concept of straightness cannot be attached unless it is made to apply to the medial plane of the whole universe. Each divergent movement from this plane, whether on the part of individual solar systems or of any minor body in any particular system, would result in making the medial plane of this system or body a curve in its relation to the major body or to the whole universe. Each body exerts a dimensional influence on other bodies as well as the influence we call gravity. Each body thus tends to curve the medial plane of all other bodies whose medial planes are not parallel to its own medial plane. We should not say, therefore, that bodies move in straight lines but that they move along the line of their medial planes. Every such plane is more or less warped as it deviates from the medial plane of the whole universe. Neither should we say that space is warped, since space as we know it is a mental concept derived from our psychic experience. But we can say that practically every movement of bodies in space is warped in that each particular movement is controlled by the medial plane of the system to which it belongs and this plane differs more or less from the medial plane of the whole universe. There are thus

as many different concepts of straightness as there are planets inhabited by conscious beings.

This reasoning may seem obscure but if analyzed it will be found to differ but slightly from that used by Newton. In his discussion of elliptic orbits he assumes a central body with an attracitve force coming into relation with a small body moving in some direction not the same as that induced by the attractive force of the central body. This situation would create the centrifugal and centripetal forces which together create elliptic orbits. The smaller body must under these conditions be a body whose force is not derived from the central body. His theory of elliptic orbits is therefore a "capture" theory, the satellites being of foreign origin. He has no way of turning centrifugal force into centripetal force. I desire to show the possibility of such a transformation and thus to show how the force of the satellite is not foreign but is derived from the parent body.

The movement of an ejected body would be exactly opposite to the attractive force of the parent body if the parent body had a fixed position. The inverse movement would in time wear itself out and a return to the parent body would be inevitable. This is the supposition which Newton makes and upon which his reasoning is based. He regards the parent body as having a fixed position and thus simplifies the problem he is interested in solving. The assumption of foreign bodies captured by central suns fell in with the views of the time and hence provoked no discussion. The reasoning involved is seriously modified and much simplified if instead of a fixed central body a moving body is predicated. Now the attractive force of the parent body and the expulsive force of the ejected body will not be exactly opposite. By its own motion the attractive force of the parent body strikes the ejected body at an angle. Two forces, both central in their origin, thus act on the ejected body and its movement will be the re-

sultant of the conflict. In this way the parent body creates the centripetal force of the bodies it ejects. The direct action on a satellite becomes the centrifugal force, while the ejective force that threw the satellite away from itself is transformed into a centripetal force. An elliptic orbit results not, however, because of any capture of foreign bodies but because of changes which its own motion creates.

The dimensional influence which the central body exerts on its satellites can be explained on the same principle. Each part of a satellite will be directly influenced by what is called tidal stress. This means that each part will be lengthened on the line of its medial plane and this plane will tend to become parallel to the line of the attractive force of the central body. The satellite as a whole will tend to shape itself so that at each point its medial plane will be tangent to the line of force exerted by the central body. Its medial plane would thus tend to be a curve. In theory, each of two bodies mutually attractive should tend to move around the other, but the relation of a large central body to its satellites is such that the deviation of its medial plane from a straight line can be neglected. The apparent movement would be on the part of the satellite whose curves would be transformed into ellipses which perpetuate themselves through the combination of centrifugal and centripetal forces generated by the situation.

PLANETARY EVOLUTION.

If the doctrine of peripheral currents is valid it holds equally in planetary evolution as in that of suns. The difference is that allowance must be made for pressure, collision and friction to a greater degree than in solar systems. There is confusion, yet none but what can be accounted for if the ultimate principles are correct. We need only to alter some of the traditional assumptions whose force is

more in age than in validity. One of these is the picture of the earth as a caldron in which compounds are made as in a blast-furnace. The early earth was probably in temperature above and not below the point where compounds, metal or otherwise, are made. If the cooling-process is a change from linear to axillary motion particles would cool as they were projected to the earth's peripheral plane. Here the simpler elements would unite in the larger units and cool as they do. In the large molecules there would be more axillary motion and hence an absorption of heat. The air would thus be ladened with cold heavy particles which would be carried around the earth by the strong peripheral currents. The early earth would have cyclones and tornadoes of a type that at present we can scarcely imagine. Great masses of particles would thus be held suspended and the strength of the currents would increase as this matter grew in quantity and thus forced the peripheral currents nearer the earth. In the end, however, both from the burden and the increased friction, the currents would be disrupted and huge masses of cold matter dumped on the earth. The cooling-process thus consists of a series of aerial accumulations of ejected matter and of subsequent deposit due to the final disruption of the overladen currents. The solid external portion of a planet would grow both by the addition of cold matter drifting in from the external space and from the dumping due to the disruption of the overloaded peripheral currents.

In a measure the facts will bear out this hypothesis although to make them and the theory tally less prominence must be given to the action of water than accepted theories accord to it. The current theory assumes that the bed of the ocean was among the early formations and that since then water through aerial currents has been carried to the land and on its return has taken with it immense quantities of débris out of which stratified rock is made. I would

assume that in early ages water was mainly carried in the aerial currents falling to the earth only when these currents broke. Then we would have an ice age where these deposits were made. These would be gradually melted through terrestrial heat. Water would run toward the low parts of the earth but these being hot would soon transform it again to vapor after which it would again ascend to aerial regions until a new disruption brought on a new ice age.

If this hypothesis is correct, between each two ice ages there would be an arid age. The surface currents would be dry and hot, licking up the surface water except in protected spots. There might be lakes, ponds and small streams but no ocean as we now know it. These arid periods would give a hot climate to a much larger portion of the earth than now. It might even extend into the polar regions and make them the spot for early vegetation. The dry ages would turn the earth into vast deserts with a tremendous surface drift of material due to the strong hot currents of the air. The drift of sand in our present deserts would be an index of the larger transformation of land taking place in earlier ages. Drift on the surface, dumping from above, and ice would then be the main agents in giving the earth its present form. The bed of the ocean would be where it is but in it water would not remain permanently until the ice ages pass. When the earth is cool enough to have a permanent ocean these early transformations of its surface would cease and bring the minor forces into control which at present manifest themselves. Oceans would thus be among the last features of the earth to be formed even if we assume that the ocean-beds were in formation from the very start. The bulging of continents and the depression of ocean-beds are due to forces not unconnected with aerial currents and yet disconnected with the presence or absence of water in them.

I have assumed that the resolution of forces due to the upward movement of hot particles would create two peripheral currents moving in opposite directions. The heavier material would be in the inner current, the lighter in the outer. When the break comes and the cold deposit takes place the lighter material from the outer current falls on the northern hemisphere while the heavier material from the inner current falls on the southern. That the dominant currents north and south have different origins is indicated by the fact that southern tornadoes revolve in an opposite direction from the northern. All storms thus seem to have their origin in these upper currents, and if so, their source can be determined by their circular direction. If this is in a measure true the northern deposits would be colder and lighter, mainly of ice. The south would thus not only grow heavier but the northern material would either flow south as it melted or would rise again and be absorbed in the peripheral currents. The growing weight of the south would thus depress its material and cause a rise of the lighter material at the north. This would in a rough way correspond to the known facts and thus make the aerial currents a source of the uplifts and depressions on the earth's surface.

According to the Laplacian hypothesis the planets were formed by contraction when the body of the sun extended to the orbit in which each planet now moves. A huge mass is thus thrown off at once out of which the planet is built. The outer planets are thus the older and hence should be the colder, which is not a fact. In contrast to this I assume that the material of each planet accumulated gradually when its orbit was the peripheral plane of the central sun. Part of the sun's matter would thus be forced upward to it by heat while another part would come from the cold material which drifts in from outer space. The accumulated material would in the end cause a break in the periph-

eral currents and then a hot body would result from the conflict of the two peripheral currents, the same as in the original nebula from which the sun arose. Planet-formation is thus the same in origin as sun-formation, the difference being only in the magnitude. If this is the case the inner planets are the older and the whole planetary system much younger than the Laplacian hypothesis assumes. At first the attraction of the sun would be too strong to permit material to remain on any external plane. There might be great masses of material thrown outward but it would soon sink back into the original body because of its heat. Only after considerable shrinkage would a permanent peripheral circuit be possible and then only could planet-formation begin. At first the current would be near the central body and contain much heavy material, but as the material cast off became lighter the peripheral current would be farther away and have for its content the lighter gases. To this scheme the planets conform. The outer bodies are lighter and hotter, indicating a later origin. The inner planets are about four times as heavy as the outer and show more fully the marks of age. The asteroids seem to be the remnant of an early planet while Mars by its cracks seems on the verge of a like dissolution. If heat and lightness are the indices of youth the planets do not conform to the demands of the accepted hypothesis of their origin.

I wish to emphasize anew how important is the hypothesis of two opposing peripheral currents in any purely physical explanation of a cosmic universe. Even the smallest bodies tend to form a nucleus and two opposing currents. This seems to be the only plan which permits cosmic evolution. The difference is not in this simple cosmic struggle for order and permanence but in the opposing forces which promote dissolution. Small bodies are more subject to pressure, collision and friction than are the orbs

which float in outer space. They thus lose the symmetry which the larger bodies have but at bottom act in the same way insofar as cosmic forces control. A thunderstorm or a cyclone show the same striving for orderly movement and are disrupted in the same fashion as are the currents of the immense outer circuits from which huge nebulæ are formed. Matter assumes chemical and electrical forms as the cosmic forces are overpowered by the dissolving energy which pressure, torsion and friction exert. They create unstable products so at variance with the underlying cosmic plan that they seem causes rather than consequences. Yet each of these is the result of the simple cosmic forces they seem to overthrow. If energy tends to aggregate all else follows in an orderly series, each step not leading to an ultimate but to some form which tends to restore the original condition. Cause becomes effect and effect in turn is cause. The opposites are thus in the end harmonized since they both are parts of a repeating process.

The construction of solar systems is best explained in Professor Chamberlain's *Origin of the Earth*. To it the reader is referred, but there are differences between his explanation and mine due to the rigid way in which he holds to the Newtonian laws of motion. If these laws are not absolute but secondary expressions of the conservation of energy there is an easy transfer from his view to mine. I go a step farther back than he does in seeking the beginning of planetary evolution. The mechanism of peripheral planes would lead to the formation of knots and spirals from which he takes his start.

The first difference, however, would be as to the way in which planets are formed. He assumes they are ejected as a solid mass due possibly to the influence of some colliding body. I would say that planets are formed by the same processes which create suns. The scale is less grand but the forces are the same. Every hot body ejects small

particles. If the principle of inverse acceleration is correct a steady stream of swift-moving particles would be ejected from the central body which would form peripheral currents like the original currents out of which the central body arose. The same forces would ultimately create a new knot with spiral movements and in the end a new planet would appear.

A second difference would result from the place where heavy material originated. Professor Chamberlain infers that the interior of planetary bodies is heavier than their external parts. This would seem to be due to the tacit assumption that the combinations which increase specific gravity arise as the heat of compression increases. I would regard it as more probable that the combinations are made not at the center but at the peripheral plane. Hot particles are ejected. They cool and unite. Then they fall back on the surface of the central body. The crust of a planet would then be composed of heavier material than its interior. If so, the distortions, elevations and depressions of the planet's surface receive a ready explanation.

These doctrines seem to break with the accepted laws of physics, but in reality they merely generalize them. In the place of constants capable of verbal expression, variables are inserted for which language has no equivalents. Transform Newton's verbal laws into mathematical formulas, and all the alteration can be made which the new physics demands. The two new variables of which I have made use are those relating to gravitation and reaction. If gravitation falls off as bodies cool, the measurements of gravitation are an inadequate expression of the activity involved. If also the reaction after collision is not the same for all particles, there being a transfer of motion from heavy to light particles, the verbal law again fails and a mathematical formula is needed to express the old relation in new terms. But none of the ultimates are al-

tered by this change from concrete words to mathemathical language.

There is another way of expressing this fact which needs emphasis. The absolutes which have crept into science are remnants of psychic postulates which dominated human thought before the dawn of the scientific epoch. Thought was then moulded by the psychic attitude of the observer and was regarded sound if it could be stated in dogmatic postulates. To eliminate these psychic presuppositions is to change rigid verbal laws into mathematical formulas each member of which is a variable. It is these unbending psychic postulates which are now being questioned, and science becomes pure as they are being eliminated. Nature is variation and sequence, not rigid and absolute. When verbal laws are judged in this fashion their psychic defects become apparent. Straight is a psychic absolute. So is equality in the phrase "Action and reaction are equal." The real physical tendency back of these formal statements is expressed by the conservation of energy which has no psychic equivalent.

One group of thinkers regard the psychic as ultimate and interpret nature in its forms. This is philosophy. Modern science, on the other hand, tends toward mathematical expression, thus replacing absolutes with variables. An illustration of this is given in the conflicting notions of space made prominent by the difference between Euclidean and non-Euclidean geometry. The Euclidean postulates are psychic. The non-Euclidean are designed from, or at least conform with, the actual movements of bodies in space. We predicate that light moves in straight lines and hence that bodies are where and what they seem. If, however, light moves in curved lines our psychic predicates are inaccurate. Law is not law until the psychic is eliminated, and this means that law is law only when it expresses a relation between variables.

THE PREMISES OF SCIENCE.

From the preceding discussion it can be seen what changes must be made in the statement of physical laws to bring them into harmony with known facts. This change demands not new discoveries but the rearrangement of knowledge around new centers. In the first place all psychic predicates must be eliminated because they involved an overstatement. Science is concerned with relations, not with predicates. Rigid truth is always an equation, never an unqualified predicate. Truth in the form of predicates should always state its qualification. When this is done it is transformed from a universal to a limited proposition. As soon as the equational nature of truth is recognized the conservation of energy displaces the laws of motion as the initial point of scientific thought. Motion must so act that it conserves itself. Its laws must be restated in a way showing their subordination to the conservation of energy. This takes from them their universal character and breaks them up into specific predicates each true only under particular conditions. To show how this can be done I append a restatement of physical law as it appears when the conservation of energy is given the first place. Nothing is then true unless it can be stated as a mathematical equation. All predicates which are not equational are so stated that their limitations are plain. In the background is the assumption that the only ultimate form is attraction and that the acosmic forces, such as pressure, friction, torsion and the like, are the resultants of the primary force which they thwart but never surpass.

1. Gravitation is a complex force due to attraction and pressure. Attraction is a constant force while pressure varies inversely to the square of the distance from the center of gravity. This increase of pressure is the cause of

the acceleration of falling bodies. Acceleration is thus a reversal, not a primary force.

2. Every cosmic process has its antithesis in an acosmic process which dissipates the energy the cosmic process would centralize. Of these acosmic processes pressure, collision, heat, friction, electrical antagonism and reverse acceleration are examples.

3. The quantity of energy, although remaining unchanged, assumes two forms, kinetic (linear) and molecular (axillary).

4. Units of linear energy move toward each other with a speed inverse to their mass.

5. Axillary energy is inert but under pressure repulses similars and coalesces with opposites.

6. Motion is a transfer of energy. No body can alter its velocity without an opposite change in some other body.

7. If there were but one body in space there would be no difference between motion and rest. An unrelated body moving through space is an absurdity.

8. There is no motion without the dissipation of energy, nor is any force lost, yet in collision there is a transfer of energy. Small particles like heat and light may thus be thrown beyond the influence of the bodies in which they originate.

9. Attracted bodies move toward each other along the shortest available path. Repulsed bodies move from each other on the path of least resistance. Of the straightness of these paths there is no objective measure. Whether these paths are straight or not depends on the stress and opposition to which bodies are subjected.

10. Every body in the universe exerts not only an attractive force on every other body but also a dimensional force which alters the plane in which it moves.

11. Bodies tend toward stability by the emission of dis-

cordant motions which are dissipated as vibrations or ejected by giving increased velocity to small particles.

12. Heat is absorbed by the growth of molecules and given off by their division.

13. Cold bodies tend to disintegrate, while hot bodies increase their attractive force with their heat-growth.

14. The energy of electricity is the energy of pressure making the laws of pressure and the laws of electricity the same.

15. The acceleration at any point is equal to the pressure at that point.

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THE END OF MARK IN THE CURETONIAN SYRIAC

AND THE FUTILITY OF USING IT TO SUPPORT THE APPENDIX.

IT is well known that, in the London manuscript of the Old Syriac Gospels, the whole of Mark is missing except verses 17-20 of the last chapter. The fragment reads thus:

...that believe in me; these in my name shall cast out demons; with new tongues they shall speak; serpents they shall take up in their hands; and if any poison of death they drink, it shall not hurt them; on the diseased they shall lay their hands, and they shall become sound.

But our Lord Jesus, after that he had commanded his disciples, was exalted to heaven, and sat on the right [hand] of God. But they went forth, and preached in every place, and the Lord [was] with them in all, and their word he was confirming by the signs which they were doing.

Endeth Gospel of Mark.

In the first edition of this Version (London, 1858, p. xliv) William Cureton, its discoverer, said:

"This very small remaining Fragment of St. Mark is an early testimony to the authenticity of the last twelve verses of this Gospel, which have been deemed spurious by some critics."

In 1912, Sir Frederic Kenyon can still say of this fragment, that it "is sufficient to show that it contained the

last twelve verses of the Gospel." (*Handbook to the Textual Criticism of the New Testament*, 2d ed., London, 1912, p. 155.)

Yes: it contained them, but did it ascribe them to Mark? *Until we know what an ancient manuscript said at the juncture of the Gospel and the Appendix, we cannot tell how it treated the latter.*

Now, there are only two manuscripts extant of the Old Syriac Version: viz., this one and the Lewis Syriac on Mount Sinai, which omits the Mark Appendix altogether, clinching the omission with the red colophon at xvi. 8:

Endeth Gospel of Mark.

But while the Old Syriac has been reduced to two manuscripts, the Old Armenian survives in hundreds, five of which are in Philadelphia, and at least one apiece in Boston and New York. (There is a Syriac fragment in Berlin which probably belonged to the London Manuscript when it was in Egypt before 1842, and which shows the absence of the woman in adultery from John viii.) All scholars agree that there is a close relationship between these two neighboring Versions, the Syriac and the Armenian. Indeed, Armenian historians testify that their first translation was made not from Greek, but from Syriac. As was shown in a former article,[1] all Armenian manuscripts before A. D. 989 end Mark as does the Sinai Syriac, with the red colophon at xvi. 8. It was further shown that even those manuscripts which contain the Appendix often adopt various devices to mark their disapproval of it. One ascribes it to Ariston the Presbyter in a rubricated title squeezed in between verses 8 and 9; others say at verse 8:

Read for the Ascension.

[1] "The Six Endings of Mark in Later Manuscripts and Catholic and Protestant Imprints of the Old Armenian Version." (*Monist*, Oct., 1919.)

Others add the Appendix, but put the old colophon at xvi. 8, showing that this was the original end of the Gospel, fixed by the first translators (early fourth century, as Kenyon himself informs us, *op. cit.*, p. 172). They then begin the Appendix with a repeated title:

Gospel according to Mark.

Frederick Conybeare has told us that the Armenian Version is so slavishly literal and so accurately copied, that a medieval Armenian manuscript is equivalent to a Greek one of the fifth century. He might have added, or a Syriac one of the fourth.

Besides Armenian Manuscripts, Codex L at Paris, and other Greek ones, such as No. 1 at Basle and 209 at Venice, support my contention, as well as the Old Latin at Turin and the South Egyptian Version.

Now, *until we know what the London Manuscript said at Mark xvi. 8, we must cease to quote it as an authority in support of Aristion's Appendix as part of Mark.* Therefore, all critical editions of the Greek Testament, including Tischendorf, Tregelles and Soden themselves, must be corrected in their apparatus at this point.

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P. S. I have just secured the photograph of the oldest Armenian manuscript, A.D. 887 (Moscow, 1899). Of course it omits the Mark Appendix, the Adultery Section in John, the Bloody Sweat in Luke, etc.

CRITICISMS AND DISCUSSIONS.

ON REALISM.[1]

It is of the so-called New Realism that I wish to speak in the present lecture. The neo-realistic movement is one which has arisen among certain American university philosophers within the last twelve or fifteen years and which reached its most adequate expression in a cooperative volume published in 1912, entitled *The New Realism.* It is to be noted that a similar and related English realistic movement developed during the same period but that this movement cannot claim to have reached as high a level of systematic formulation as the American movement. At any rate, the subject of our present discourse is the American realistic school rather than the school of Nunn, Alexander, Moore and Bertrand Russell (in his earlier development). The chief documents for the study of the American realistic school are the collection of papers just mentioned, Perry's *Present Philosophical Tendencies*, Spaulding's *New Rationalism* and Holt's *Concept of Consciousness.* The literature is thus delightfully slight in quantity! (There are, of course, many works of realistically inclined philosophers, which would deserve enumeration in a complete bibliography.)

The chief characteristic of the realistic movement is undoubtedly its negative and destructive character. The realist practises a severe and unrelenting criticism upon all existing systems of philosophy. He tears down the pleasing speculative structure of absolute idealism, with its religious and esthetic values, and he is equally willing to show the flimsy character of pragmatic relativism. It is only natural, therefore, that those who have been accustomed to draw intellectual and emotional satisfaction from either of the two dominant systems regard the realistic polemic with no small degree of apprehension.

The realist approaches the problems of philosophy in a spirit

[1] A Public Lecture delivered at the Rice Institute, April 21, 1920.

of exact reasoning. His ideal is that of exact science. It is precisely at this point that he is opposed by the dominant schools. Both pragmatists and idealists have, under the influence of romanticism, persuaded themselves that exact science is, as they say, abstract, and thus not true of the concrete world. They believe that mathematics and physics are merely games played with abstract concepts which lead us the further from the truth, the longer we play. The real, wherever it may be found, is not (pragmatists and idealists agree) the world of mathematical science. And philosophy itself must not have an exact and rigorous form. It must be speculative, profound, suggestive, rather than precisely true. Now the realist differs from the pragmatist and the idealist in demanding that philosophy be an exact science, or at any rate as exact as possible; that it work in the spirit of mathematical and natural science. And in making this demand for close correlation between science and philosophy, realism is true to one very important tradition in the history of philosophical thought. Side by side with the speculative and theological tendency we have a scientific tendency running through the whole history of philosophy. Plato, Descartes, Leibniz and Kant may be mentioned as having connected philosophy with exact science; Aristotle and Hume as having connected philosophy with biological and psychological science respectively.

Realism means, then, first of all, an examination of existing systems according to canons of rigorous argumentation. In the course of this polemic, however, a certain beginning is made toward reconstruction. The future of realism no doubt consists in carrying on the work of positive and constructive thinking. But for realism it is not of prime importance that a system of philosophy be reached; what is important is that the canons of scientific method be observed. If no system can be reached by these methods, then we must have no system and the business of true philosophy must consist in a perpetual refutation of all false philosophies.

What, then, is the realistic doctrine? First of all, it affirms the theory of epistemological monism. This doctrine is one which is frequently found among philosophers but which is often made the basis for false inferences. Epistemological monism affirms the identity of the perceived or otherwise cogitated object with the real object. The opposite of this is the doctrine of representative perceptionism, which holds that when I perceive a tree there are two things involved, first the tree, and secondly my idea of the tree, and

that my idea of the tree may be like the tree, in which case it is true, or unlike the tree, in which case it is false. This correspondence theory of truth, this assumption of a duality between ideas and things so that the former can copy the latter, realism rejects. And in doing so it is in accord with the weight of philosophical opinion at the present time. The difficulties of epistemological dualism have often been exploited. If my idea of the tree is true when it corresponds to the tree, how can I ever become aware of the truth or falsehood of my idea? For when I attempt to compare my idea of the tree with the tree, it turns out that the latter is itself only known through my idea, and that, consequently, I can only compare my idea with itself and never with the outer object. To compare the idea with the outer object implies some sort of direct contact with the outer object and that is just what representative perceptionism or epistemological dualism denies. The realist assumes the possibility of knowledge, consequently the possibility of distinguishing the true from the false, and he is thus logically forced to deny the dualistic theory, although it must be said that this dualistic theory is almost the only one known to common sense and is embodied in many linguistic forms.

Now this rejection is the point of the first article of Perry's "platform" (1910): "The object or content of consciousness is any entity in so far as it is responded to by another entity in a specific manner exhibited by the reflex nervous system. Thus physical nature, for example, is, under certain circumstances, directly present in consciousness. In its historical application, this means that the Cartesian dualism and the representative theory are false; and that attempts to overcome these by reducing mind and nature to one another or to some third substance are gratuitous."[2] We may note that this plank implies Perry's special theory of consciousness, which, however, is not accepted by all the other realists. This theory of consciousness has the merit of extreme simplicity, for it consists in the sharp denial that there is any distinct type of being to be found corresponding to the word consciousness. The notion of consciousness, of an inner mental life, different from, although mysteriously related to, the bodily life, Perry holds to be a superstition.[3] What is real about consciousness is simply the fact that beings said to be conscious make certain responses to the environment which others do not. We assume an inner principle to explain

[2] Cf. *Journal of Philosophy*, etc., 1910, p. 393; *New Realism*, p. 475.

[3] Cf. *Present Philosophical Tendencies*, pp. 271ff.

these responses, and we call this principle consciousness, but we know only the manifestations of the principle. It is behavior that is observable and consciousness is merely the assumed metaphysical explanation of behavior; now the elimination of consciousness from our list of real beings is in accordance with the general tendency of modern science to eliminate non-empirical explanatory principles, essences, vital principles, etc., and to keep to the observable facts themselves. I do not wish to express an opinion on the behavioristic theory of consciousness, which has to explain away a good share of introspective experience before it can claim to be established. I merely wish to mention the fact that Perry suggests a definition of consciousness in terms of behavior in the course of stating the doctrine of epistemological monism. The two are not necessarily connected. The object which is the content of consciousness and the "real thing" may be one and the same, numerically identical, whether we define consciousness in terms of mental process or mental activity, according to the traditional notion, or whether we define consciousness in terms of physical response. And it is the former doctrine which is essential in realism.

The second thesis of Perry's "platform" is a denial of Berkeleian idealism. This denial of subjective idealism is of course what gives realism its name. Now while subjective idealism is, from the point of view of common sense, an extremely paradoxical doctrine, it nevertheless forms the key-note of a great deal of the thinking that falls under the more general heads of idealism and pragmatism. Subjective idealism may be briefly described as the position that the world exists only as the content or idea of consciousness. There is no external world, according to this doctrine, but only souls and their ideas. The regular order which we observe in our ideas, by which one idea tends to be followed by the same idea on each of its occurrences, is produced by the direct will of God working on our finite souls. There is no permanent tree which we can experience or perceive at different times and which different persons can experience or perceive; but God gives our ideas a certain regularity or order which causes us to believe falsely that there is an independent tree. As Schopenhauer said, the world is my idea, and the only difference between the real world and the world of dreams is the greater regularity and system to be found in the so-called real world. Such was the doctrine of the bishop Berkeley, who thought

to have found an invincible argument against materialism and atheism by denying the existence of a material world altogether.

Now subjective idealism, or this paradoxical reduction of the whole cosmos to ideas, is regarded by the realist as the cardinal principle of idealism. Hume was a follower of Berkeley whose radical empiricism led him to even more paradoxical consequences. Hume, in a word, abolished the soul (and tacitly God). He thus reduced the world to a chaotic stream of sense-impressions. And the philosophy of Kant, from which all modern idealism flows, is an answer to Hume. It consequently moves in the same world of thought in which Hume's investigations moved, and has certain deep similarities with Hume's system. For Kant the only world which is open to scientific investigation is what he called the world of possible experience, and not things as they are independently of us, i. e., things in themselves. Now it is clear that this is the system of Berkeley in a new form.

In Kant's system the world of possible experience, the world which constitutes the object of science, does not exist independently of consciousness. If no consciousness existed there would be no space, no time and no permanent mechanism of nature. Consciousness produces these things. In the first place, the sensuous world, colors, odors and sounds, etc., is relative to the sense-organ of the percipient. If there were no eyes, there would be no colors; no ears, no sounds; no noses, no odors. If our organs were different from what they are they would perceive a different world. But this is only the vestibule of Kant's idealism. Not only are the sensible qualities dependent upon the faculties of the perceiver, but the rational or logical form of the world is relative to the understanding of the thinker. It is we who arrange nature in space and time, and who subordinate it to a strict mechanical causality. Our minds read that into nature. Space and time, then, and also the categories of the understanding, causality, substance, necessity, etc., possess for Kant a subjective character. They are relative to the mind that thinks them.

The mind that thinks them, however, is not the private consciousness of the individual. Here we reach the distinctive characteristic of Kant's idealism. Kant begins by assuming the truth of mathematical science, especially as exemplified in the system of Newton, of which he was a great admirer. The truths of mathematics and physics are true for every one, valid for all minds. The

world of mathematics and physics, therefore, is an objective world in precisely this sense, that, namely, it possesses universal validity. Universal validity is in fact for Kant the very meaning of objectivity. Now if the world of mathematics and physics possesses universal validity, if its truths hold for all minds, then it cannot be the mind of the individual to which that world is correlative; it must be what Kant called consciousness in general, *Bewusstsein überhaupt*. Thus Kant is obliged to make use of the notion of a universal mind, to which all the phenomena of the world of space and time are relative. It is this notion of a universal mind which forms the central doctrine of what is called objective idealism. And it is objective idealism which most of the later idealists recognize as the only tenable form of idealism.

Objective idealism, then, or the doctrine that the world is relative to some sort of universal or cosmic intelligence, is an attempt to correct subjective idealism. If subjective idealism were true there could be no world of mathematics and physics with authority over all minds; each one of us could have a private arithmetic, geometry and mechanics. But Kant starts with the assumption of the universal validity of exact science. And he also assumes as part of his starting-point that what is known cannot be independent of the mind that knows it. This assumption is, as the realists have shown, the cardinal principle of idealism proper and is first clearly stated in the doctrine of Berkeley. It is this assumption which the realist makes bold to deny, thus affirming that what is known may be independent of the mind that knows it. It is obvious that in denying the root principle of idealism he has necessarily denied the more complicated and derivative form of idealism which is known as objective idealism. Objective idealism appeals from the individual mind to an assumed universal mind in order to maintain the universality of scientific truths. The realist has no need of the universal reason, for he does not admit that the world known in science depends upon or is in any way affected by the mind that knows it. Now Perry's second thesis is, as I have said, simply the affirmation of what may be called the cardinal principle of realism. "The specific response which determines an entity to be content of consciousness does not directly modify such entities otherwise than to endow them with this status. In other words, consciousness selects from a field of entities which it does not create. In its historical application, this implies the falsity of the Berkeleian and

post-Berkeleian idealism in so far as this asserts that consciousness is a general *ratio essendi.*"

So far we have merely the *assertion* of the realistic position. It is felt that the burden of proof rests on the idealist; hence, the argument for realism consists largely in the refutation of idealism. This is done by showing a number of fallacies which frequently occur in idealistic works. These fallacies the realist isolates and names, thus using the method by which Kant gave the death-blow to speculative theology in the Transcendental Dialectic of the *Critique of Pure Reason.*

The chief fallacies of which the realist convicts the idealist are those of definition by initial predication and of argument from the ego-centric predicament. The procedure of the idealist in the first case is very simple. He declares his intention of looking at the world from the standpoint of experience. This means that he proposes to regard the world primarily as an object of experience, in other words, as an idea, or perception. There is no doubt that the world is in part the object of experience; in other words, many things in the world are perceived or felt or conceived or imagined, in other words, experienced in some way. But for the idealist this aspect of the world, the world as an object of possible experience, the world as idea, is definitive. It is the very essence of the world to be a possible experience. In other words, the relation to consciousness belongs to the essential properties of the world. Now it has long since been observed that the "essence" of a thing depends upon the point of view from which you regard that thing. Thus a table presents a different character depending upon whether it is approached from the standpoint of physics or chemistry or biology, the latter regarding the table as essentially made up of wood from a certain variety of trees. The idealist regards the psychology of the table, the table as a perception, or as an idea, as the ultimate and definitive essence of the table. It is true that the table can very well be regarded as an experience or as a perception, but what the idealist has not proved and cannot prove is that the psychological way of approaching the table has any higher degree of ultimacy or absoluteness than the physical or chemical ways. He defines by initial predication; that is, he first regards the table as a perception and he then arbitrarily considers this one aspect of the table to constitute the true and absolute essence of the table.[4]

[4] Cf. Perry, *Present Philosophical Tendencies,* p. 126; *New Realism,* pp. 14f.

We may remark in passing that the whole tendency of realism is to deprive psychology of the falsely central position it has assumed. The realist arranges the sciences in a certain order, an order based on the logical dependence of one science upon another. Thus physics depends on mathematics, but mathematics is independent of and anterior to physics. Arranging the sciences according to this principle he gives the first place to the abstract and formal sciences, namely, logic and mathematics, the second place to physics, then comes chemistry, then biology, and lastly psychology as dependent upon all the others. Thus realism is opposed to psychologism, which would give the most complex and derivative science of all the position that belongs to logic and mathematics. But the reign of psychologism in American philosophy, whether as a part of idealism or of pragmatism, is only disputed by the realist.

The second fallacy pointed out by the realist in his attack on idealism is named the fallacy of argument from the ego-centric predicament. This argument is shown to occur in the system of Berkeley and also in other idealistic systems. The idealist draws an unwarranted conclusion from the ego-centric predicament in this way: To establish his conclusion the idealist calls on the realist to show him something which is not perception, experience, idea. The realist, perhaps, refers to the side of the moon which is never turned toward the earth. Here, he says, is something which is not experienced, and is not perception or mental content in any sense. There is no reason to suppose that any actual mind perceives the remote side of the moon. But to this the idealist replies: Ah, but you are thinking of the other side of the moon now yourself. You can't think of it without thinking of it; consequently even the other side of the moon is dependent upon consciousness. Now the ego-centric predicament consists in this undoubted but tautologous fact: that what you think of, you think of. The idealistic fallacy is to infer from this flat tautology that the opposite side of the moon, to revert to our example, exists only in consciousness. It is true that the realist is unable to think of anything which is not thought of by him at that moment, but it by no means follows that there are not many things in existence which are not content of any sort of consciousness.[5]

The realist, then, believes in the independent existence of an external world. But this doctrine is only the beginning of realism.

[5] Cf. Perry, *Present Philosophical Tendencies*, p. 128; *New Realism*, p. 11.

From a technical point of view the most important realistic theory is probably the external theory of relations. This theory too is negative, being a denial of the theory advocated by certain of the absolute idealists. The controversy between the internal and external theories of relation certainly constitutes one of the most fine-spun discussions in modern philosophy. And yet the point involved is easy to understand. For the external theory of relations is simply an endorsement of the methods of science in the face of anti-scientific criticism.

The internal theory of relations, as we find it in, say, Bradley, amounts to the theory that the world is an organic whole. Everything is related to everything else; nothing is isolated; and these relations are not accidental, fortuitous, to the things related but are essential, internal, to them. A thing's relations belong to its inseparable essence. Such is the doctrine of the idealist. He goes on, however, to say that if nothing is independent of anything else, then nothing can be known until we know everything else. This theory directly contradicts the independent and absolutely autonomous character of mathematics. It implies, moreover, that science follows a false path when it analyzes, abstracts, considers one thing at a time. It breaks up that which is by nature continuous, indivisible, and instead of mastering its object, only falsifies it. The scientist defines, examines his object now under one set of circumstances and now under another, and endeavors to measure the effect of each set of circumstances on his object. If, however, the world is a living organic whole, if everything in the world is inextricably bound up with everything else, then scientific analysis is impossible.

It is against this mysticism, this theory of the impotence of exact science, that Spaulding directs his thoroughgoing *defense of analysis.*[6] His essay is the third in the realistic treatise. In this essay he examines and, it would seem, refutes all of the current objections to scientific analysis. Not only is the so-called internal theory of relations of Bradley exposed but also the more or less obscurantist positions of Bergson, with their facile appeal to intuition. This discussion is, however, so technical that it would probably not be profitable to enter into it here. We may note, however, that it is the doctrine of the necessity of scientific analysis upon which the realist takes his stand in exposing what he is pleased

[6] Cf. *New Realism,* pp. 155ff.

to regard as a typical idealistic fallacy. The error of pseudo-simplicity has been one of the chief possessions of the idealists. This fallacy consists in arguing that because a thing is simple before analysis it must be so afterward. It confuses the immediate, first-hand simplicity of an experience, a simplicity which is simply the correlate of our ignorance, with the simplicity of that which is regarded as resisting further analysis on some rational grounds. The realist, in other words, takes a strong stand against immediatism. The immediatist appeals to his "immediate," unreflective experience, his "concrete" experience, and he regards this crude starting-point of knowledge as possessing higher authority than the same experience viewed in the light of scientific analysis and reflection. The realist finds, for example, that consciousness has been given a pseudo-simplicity. We are thought to have an immediate, intuitive, apprehension of our selves, our wills, our intellects, etc. Every attempt to analyze consciousness into simpler elements is met with the charge that consciousness is itself simple, unanalyzable, immediate; that we cannot reduce consciousness to its psychological elements without destroying its peculiar essence. The realist and the experimental psychologist, however, regard this apparent simplicity of consciousness as a pseudo-simplicity. Consciousness *seems* simple only because we have not tried to analyze it.

Another example would be *life*. The vitalist regards life as something ultimate, something which resists all analysis into terms of physics and chemistry. The processes of the living organism are thought to possess a unique and irreducible essence which transcends all varieties of mechanical interaction and chemical combination. The realist would regard life as possessing only pseudo-simplicity. It is simple to unreflective experience, simple in the concrete life of the unscientific. This immediate simplicity is, however, no guaranty that life is ultimately simple. On the contrary, the evidence seems to show that life is a peculiar resultant of certain highly complex mechanical and chemical processes. The realist would not deny the tautology that life is life, but he would insist that life is essentially a complex thing which can only be understood in terms of the simpler processes that go to make it up.

The realist thus takes his stand on the results of scientific analysis and reflection, upon the world as understood, as seen by the intellect, rather than the world as immediately given, that is, as it

is found in crude experience. The preference for the world of unanalyzed experience, for what is vague and unintelligible, however, is very wide-spread among contemporary writers on philosophy. This spirit of anti-intellectualism can no doubt be traced back historically to the influence of Rousseau and romanticism, with their doctrine of a return to nature. The gospel of science, however, is rather that of an advance to nature, nature being precisely what the savage, with his immediate experience, does not understand, being, in fact, not the starting-point but the ideal, and infinitely removed, goal of scientific research.

The opposition between realism and pragmatism, while obvious to the expert, was not on the surface in the early days of the realistic movement. On the contrary, there seems to have been a good deal of sympathy between the two opponents of idealism. In the most recent realistic publication, however, Spaulding's *New Rationalism*, we find one of the most severe and unrelenting critiques of pragmatism which has yet been made. And the cornerstone of this critique is precisely the argument of Plato in the *Theatetus* against the Sophists of ancient Greece. It is in fact the ultimate objection against all forms of relativism and skepticism: that, namely, all the theories which say that man is the measure of all things and that there is no truth, all these theories themselves claim to be the truth and thus contradict themselves. In the extreme form of pragmatism it is maintained, says Spaulding, "that the very 'ideas' or principles of truth, of right and goodness, of correctness, and, indeed, of all tests and criteria, have *evolved,* and that these ideas and principles have persisted, because of their useful and satisfactory character. But the thought of a realm of *facts* that are *independent of being known,* and that, if known, are not influenced by the knowing, *still lurks* in the minds of the *adherents* of this degree of evolutionism, as is shown by the attitude that is still taken toward their own theory. For it is maintained that this, at least, portrays *'things' as they are,* and the natural sciences are still drawn upon to furnish many of the details. *And thus the Realism in the position still persists.* Finally a desperate attempt is made to remove this last inconsistency by applying the concept of *evolution* to the very *idea of a real 'world'* and to the *knowledge* of all those details in terms of which, because of the development of language, of beliefs, of conventions, and the like, this 'world' is *thought of* by human beings. All that we regard the world to be,

either *en masse* or in detail, is here interpreted as man-made. This is pragmatism's *humanism.* If man were a lion, then were God also a lion, said Xenophanes. 'But man is man,' says humanism, and, therefore, is *everything after the image of man.* But whether even this advanced degree of pragmatism's evolutionism is sufficiently consistent is still a question. For, it is still important to ask, whether *man himself* is thus known *as he really is,* or only as a *mere invention,* a growth, a 'working point of view,' an hypothesis? But, if he is this, then it may be asked, Where is the leverage, the resting-point, the *πού στῶ* of the system? Must there not be 'somewhere' a reality that is *not* man-made, that is *not* relative, and that is not dependent in any way whatsoever, on being known? *Does not the position presuppose* this, and, also, that this reality is correctly known, even though it be [known] only as a pliable, plastic 'something' that as knowing-processes appear in the evolutionary series, may be modified, altered, and, in short, 'made' *in the form in which it is now known by virtue of its causal relation to the knowing process*? Finally, is this radical evolutionism *itself* man-made and humanistic, and relativistic in the sense that another theory might have become man-made? Or does it present the real state of affairs? To these inquiries the reply must be, that Humanism presupposes a definite *ontology,* and that it accepts this ontology on the basis of a *realistic epistemology.*"[7] Thus "no matter what attitude the pragmatist may will explicitly to express in indignant denial of this, [pragmatism] contradicts itself by explicitly developing the definition of all truth as relative and by then making a tacit exception to this definition as regards the truth of itself as a theory."[8]

The realist is thus interested in showing that pragmatism itself presupposes its opposite. This is in line with Kant's endeavor to get back to the ultimate presuppositions of knowledge, the unyielding logical foundations of thought. The contemporary realist differs from Kant, however, in largely concerning himself with the logical foundations of existing systems of philosophy rather than with the logical foundations of science. Spaulding states in his Preface that the purpose of the *New Rationalism* is to "ascertain both what are those postulates from which each philosophical system is derivable, and also whether there is finally, one body of principles that is common to all systems and logically presupposed by them."[9]

[7] *Op. cit.,* p. 297.
[8] *Op. cit.,* p. 301.
[9] *Op. cit.,* p. vi.

It is his "conviction both that there is such a 'doctrine' difficult though it may be to discover what it is, and also that this doctrine is logically present in every attempt to philosophize rationally."[10] The system of realism thus consists in a set of ultimate logical postulates which are contained, whether implicitly or explicitly, in all attempts to construct a system of philosophy. It may very well be true that no thinker has yet presented, or even can at the present time present, an adequate formulation of these ultimate principles; their nature constitutes on the contrary the essential and unavoidable problem or task of philosophy.

The realist, however, is interested in the presuppositions of other systems of philosophy rather than in the presuppositions of the sciences, and herein consists his essential limitation. No doubt the realists have done much to reestablish that healthy correlation between science and philosophy which is always the sign of sound philosophy, but it is hardly to be denied that they have devoted the greater part of their energies to the technical refutation of other systems of philosophy. This work was necessary and has been well done, but the spirit of realism cannot rest with this result. It must rather advance to the consideration of the foundations of the sciences themselves. And in doing so realism will necessarily establish new relations with all those of the classical philosophers who have already labored on this problem. The problem of the logical foundations of the sciences is really identical with that of what Kant called transcendental logic. Kant's problem, in turn, was not a new one but was rather the perennial problem of the scientific tradition in philosophy. Plato, Aristotle, Descartes, Leibniz, Locke, Berkeley and Hume can all be studied with profit on the question of the logical foundations of science. Realism, in other words, must lay aside its spirit of youthful revolt from the history of philosophy and learn all it can from the great thinkers of the past. And, secondly, realism must press on to more detailed knowledge of the sciences themselves both in their historical development and in their present status. No single mortal can now hope to encompass the whole sphere of science, but a wise division of labor and concentration upon essentials can accomplish much. In this way a definite contribution will be made to the persistent problem of the logic of the sciences.

The system of ideal postulates which will be evolved will more

[10] *Ibid.*

or less adequately explain the history and present status of each of the sciences. It must not be thought, however, that this system of ultimate logical postulates will ever be brought, in the course of human history, to a complete and final formulation. The work of the criticism of science, like that of science itself, is essentially eternal. Each generation of thinkers must formulate anew its theory of science as well as its theory of everything else. And self-evidence can never be an adequate test of what constitutes a true scientific presupposition. What is self-evident to one may not be so to another. The philosopher must in the end rely on his concrete insight into science in its historical character. The presuppositions he seeks will evidence themselves by their efficiency in rendering science intelligible, in showing it as a unified system. A further development of science will therefore always demand a reconsideration of what were supposed to be the ultimate logical foundations of science. Thus the evolution of systems of non-Euclidean geometry was profoundly significant for the philosophy of mathematics, while the recent Einstein-Minkowski theory of relativity in mathematical physics will no doubt involve far-reaching changes in our notion of what physics is.

Realism, then, has practised an effective criticism upon the more or less frankly anti-scientific doctrines of idealism and pragmatism (speculative theology and skeptical relativism) and has itself made some start in understanding the logic of the sciences. Spaulding's critical attitude toward the concepts of substance and causality, the bulwarks of the Aristotelian logic, is, as may be safely said, a decided step in the understanding of the mathematical sciences. Nevertheless, granted that realism is to have a continued development, is not its line of growth in the direction of a more inclusive appreciation of science as it actually exists and of the classical philosophers in so far as the latter have worked on the theory of science?

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FREEDOM IN THE WORLD-SOUL.

A PLEA FOR BERGSONIANISM.

"There is only one thing stronger than armies; it is the Idea, when its time has come."—Victor Hugo.

The ideal goal toward which mankind has been striving in its effort to realize itself has been the complete unification of the race and the attainment of perfect freedom. All progress in civilization may be regarded as so many stages of advance toward this goal, and if we accept the Bergsonian view of matter evolving under the urge of the vital impetus, we may say that the whole course of developing life illustrates the same progress and points definitely to the same goal. Why has the goal not been reached? Why has our civilization, apparently at its highest point in material achievements and in thought, gone bankrupt? Why did it culminate in the terrible world catastrophe which has just inflicted upon humanity such appalling losses of life and treasure?

It is imperative at this juncture to take stock of humanity's possessions, to make an inventory of its assets, if we are to know why it has failed to meet its liabilities in the past and how it is to discharge its debt in the future.

On the material side, our civilization boasts unprecedented wealth, the product of man's brain and brawn. Have the stores of material riches helped to stabilize human destiny and life, and have they furnished proofs of their intrinsic value? The lesson is quite fresh. They were drawn upon to provide the very weapons for mankind's destruction. Material progress, while undoubtedly contributing much to the amelioration of social conditions and the preservation and enhancement of life, has fallen short of equity, inasmuch as it lacked the power to assure humanity's permanent freedom.

In the realm of the intellect, apart from science, the handmaid of material progress, what has been the contribution of philosophy with its vast heritage, ancient and modern? Man has speculated upon the why and the wherefore of this world ever since he began to think. The quest for the world-soul has extended through the ages—from Plato with his Idea—the pre-Christian knight of the Holy Grail, to the Good-Will of Kant, rising from its solid foundation of time and space, to the ever-present, yet ever-eluding Abso-

lute of Hegel, to the Will of Schopenhauer, encircling within its steel ring the will-o'-the-wisp of human existence, to Nietzsche's Zarathustra, dancing with his shadow. All contributed their quota to the heritage of intellectual aristocracy. Each and all left a distinct trace upon human thought, yet were powerless to stay the disaster which has overtaken mankind.

Prince Troubetskoy,[1] after reviewing philosophical progress, comes to the conclusion that, though always revolving upon itself, philosophy has failed to provide a pivot for human destiny.

Thus far, then, neither material wealth nor intellectual heritage has been able to set mankind free. Will not the awakening social conscience, together with the gradual realization of their power by different social groups, bring in the millennium along social and industrial lines? And labor movements, socialism with its various ramifications—are they not able to accomplish humanity's complete freedom? Under present social and industrial conditions, with their incentive of material reward, their motive power the struggle for existence, the awakening social conscience must needs rely on force for the gradual curtailment of the privileges of the few in the interest of the many. We hear much nowadays of the new democracy. Never before in the history of mankind, with monarchies tottering to the ground, have the masses of the people so asserted themselves, have the workers of the world so eagerly pushed forward to seize on what they think is their rightful due. The old world is passing away, and before our very eyes the new world is being born. In this new democracy the worker will call for a larger and larger share in the product of wealth, with a corresponding curtailment of capital's power. Will labor stop short of dispossessing the capitalist, or will it dispossess him, as Marx taught it should? What if capital is finally overthrown? Will that bring in the millennium, obliterate all strife, achieve full equity, lead to man's complete and perfect freedom? The example of the Bolsheviki is before us for an answer. A thoroughgoing social reformer may object on the ground that the Bolsheviki are bunglers, that under better leadership, a better state could be evolved. Grant this. There may be better-ordered and better-adjusted socialistic communities. Will they be able to liberate mankind by substituting emulation for the present-day incentive of material gain? Will emulation offer a strong enough incentive? Will it knit humanity together into one whole?

Neither material progress, then, nor philosophic thought, nor

[1] *Hibbert Journal*, April, 1918.

social and socialistic reforms have proved themselves adequate to bring in perfect and permanent freedom. Our civilization has failed and gone bankrupt because of the very fact that it was founded on force, and just as long as force is its motive power, it will fail to reach the goal of the unification of mankind and the achievement of perfect freedom in the world-soul.

What is meant by the world-soul? It does not mean the merging of all human minds into a single mind, for that would signify the closing-up of all human beings into a single organism. It means that, while preserving its separate individualities, mankind shall be so unified and harmonized in purposes and ideals, that it will be able to hold them before it as a common goal and work toward their realization as a common end to be reached. In this sense the world-soul will be the sum of all human souls bound together by a common aspiration for the highest good, and seeking to bring it about by a concentration of thought and will. In harmony there is cooperation; in union there is strength. The individual soul, faced by conflicting and divergent wills, can do little or nothing. The world-soul, made up of concurrent and converging wills, with its motive for effort a grand ideal to be realized, will be able to "move mountains."

But how is humanity to evolve a world-soul? Just as sense-organs develop under the influence of external stimulus (light, for example) and in response to the need of the organism, so humanity will develop new transcendental powers under the influence of spiritual incentive and in response to its need. The goal to be reached, the world-soul, will be evolved by the unification and spiritualization of mankind, by the welding together of all life.

Bergson says: "All living beings are connected, and all yield to the same formidable thrust (*élan vital*). The animal is supported by the plant, man rides the animal, and the whole world of humanity in space and time is an immense army galloping by the side of each of us, before and behind us, in a spirited charge which can upset all resistance and leap many obstacles, perhaps even death."

The upward movement toward spiritualization and unification has characterized life and especially human life from its earliest beginnings. At first the organism is little more than an object responding physically to the influences that flow in from the environment. Gradually, as human, it acquires the power of mould-

ing that environment to its needs. A relation between the individual and his society is set up. Speech is a social product, and human thought itself is largely a social product. Men think in common. What is needed is that they shall act in common for great common ends. Hitherto this common action has been mainly on the material plane. The time has now come to unify mankind with the aid, not of physical forces, but by resort to the psychical powers which are possessed by each individual. It has been abundantly shown[2] that thought is accompanied by emanations which pass out from the brain rhythmically into the ether, set up vibrations in that medium, and are capable of influencing matter at a distance, other human brains included. The trouble with the use of this power is that it is exerted individually and for the most part unconsciously; through the conflict of individual wills, each aiming at different ends, the influence is dissipated or wastes itself in mutually opposing currents. What is needed is that it shall be organized and used consciously in the interests of human welfare. To make this possible, men must be spiritualized into sympathy with each other to such a degree that they will acquire the unity of purpose and the harmony in action which are needed for the putting forth of a common will. When put forth by a humanity thus joined together for common effort, the psychic power which it can wield will be nothing less than transcendental. For it is of its nature to go out in rhythmic waves, and rhythm, it has been shown, is the inner mode of all nature forces. The ether trembles rhythmically, the light-vibration moves through it rhythmically, all changes in nature and in life are rhythmic, from the ebb and flow of the ocean to the fluctuations of finance and the vicissitudes of supply and demand. Music, art, progress itself, all furnish illustrations of the mode by which all things change and advance. The universe pulses rhythmically, and it is by adapting ourselves to its rhythm and by utilizing it that we may share in the Divine power and become "coworkers with God."

But humanity must be spiritualized. Its need in this respect explains the influence of Bergson's philosophy with its accentuation of duration. For what is duration but rhythm at work in the universe! Bergson's method, we take it, represents transposition from one plane of existence to another by means of rhythm. Mendeleyeff's periodic law holds good not only as regards matter, but in

[2] Cf. the article, by the writer, "Mind, the Creator of Matter," *The Monist*, April, 1918.

relation to the whole of life, which rises in ever-ascending scales from the lower forms to the higher, attaining its culminating point in man, but not stopping there. For man's divine birthright, his soul, must forever urge him on to his goal—his union with God.

How shall we view this transposition? Tarde says that all spatial likenesses are due to likenesses of vibration; consequently, every form of matter and life has its rhythm. The Zen teacher propounds questions: to answer them the student must dip his personality into the universal rhythm: he must become a pebble on the seashore, or a blossoming tree, a mountain torrent, or, perhaps, his own hand.

According to Bergson, "absolute revelation is only given to the man who passes into the object, flings himself upon its stream and lives within its rhythm."[3] And further on, "The philosopher [must] not keep at a distance from things, but listen in a manner to their inward breathing, and above all, supply the effort of sympathy by which he establishes himself in the object, becomes on intimate terms with it, tunes himself to its rhythm and, in a word, lives it."[4] And Bergson's "effort of sympathy" we take to mean no less than the law of unity and harmony underlying the whole creative process. In illustration of the manner in which we can transpose ourselves to another scale of existence from the ordinary one, we may cite the example of seeing the voice of a singer, for it is now possible, by means of electricity, to make sound-vibrations visible and to follow the flow of voice-waves on the screen. So might we, were our beings sufficiently attuned, hear the Sistine Madonna.

In interpreting the philosophy of Bergson, Le Roy says:[5] "The new philosophy desires to be a proceeding, as much as, even more than, to be a system. It insists on being lived as well as thought. It demands that thought should work, at living its true life, an inner life related to itself, effective, active and creative, but not on that account directed toward external action. 'And,' says M. Bergson, 'it can only be constructed by the collective and progressive effort of many thinkers and of many observers, completing, correcting and righting one another.'"

But is not such a philosophy of thought and inner life outside the pale of external action, foredoomed by its own nature to remain chiefly in the domain of metaphysics, exotic fruit for the enjoyment

[3] Le Roy, p. 41. [4] *Ibid.* [5] *Op. cit.*, p. 23.

and degustation of the select few, but not palatable and within reach of the hoi polloi? The principle, to be vital, must be capable of universal application. Is there not any common ground upon which all, high and lowly, could meet?

That Bergson's philosophy reaches the core of the subject is without doubt, for it aims at the spiritualization of mankind, and is intrinsically related to man's future progress and destiny in the light of creative evolution. But it admits of reinterpretation and alignment with external action and life. That is to say, Bergson's philosophy must be supplemented by a concrete system of metaphysics such as Prof. James thought of writing not long before his death. Such a system contemplates the union of science and religion into one cult that would work for the greatest benefit of mankind.

Bergson's stress upon knowledge as a part of active life is of the greatest importance. In this he strikes at man's Achilles heel. Humanity has failed for the reason that its knowledge, embodying all its philosophy and science, has not represented the whole of its active life. Men, with perhaps a very few rare exceptions, have not lived and died by knowledge, for it lacked the spiritual incentive. On the other hand, men have lived and died by religion, just because it had the spiritual incentive. Our knowledge must unite with religion in one cult and must become an integral part of life. The spiritual incentive would be offered by the share man would take in creative evolution, for he would have power to create his own world; his greatest incentive of all would be supplied if he could realize that he could at last, as Bergson intimates, overcome death. For man's complete freedom will not be accomplished until he overcomes death.

Freedom, properly understood, is not a matter of legislation. Underlying it are the fundamental laws of man's spiritual development. And the "riddle of the Universe" can only be solved in the light of an ideal which should offer a working incentive to the race.

Humanity is beginning to grasp all this. Slowly it is coming to realize that our civilization lacks the spiritual incentive. Hence the trend of modern ideas in the direction of idealism and a spiritual interpretation of the universe.

Humanity at the crossroads eagerly listens for an answer to the "Quo vadis?" listens to Bergson who speaks of freedom for man to create his soul, to Boutroux who tells of freedom from the fiat of nature's laws.

The cocksure materialism of the last century, which aimed at the reduction of all spiritual phenomena to the interaction of matter and force, is generally discarded by modern thinkers, and the very science which upheld it formerly now furnishes weapons for its downfall. In the latest view of the ultimate units of power as "electrons" and the modern explanation of all energy phenomena as electrical, matter disappears, and is accessible only to idealistic conceptions. Nor does the theory of psycho-physical parallelism avail to establish the claims of materialism. It fails utterly to explain consciousness: all it can do is to proclaim the concurrence of psychical with physical phenomena. The two occur together, but why, is beyond its power to explain. No matter how much we attenuate the brain-tissue, we are unable to locate thought—the spiritual emanation of man's bodily frame—or put a finger into man's soul, his divine inheritance.

Thus, far from being void and purposeless, the world is athrob with the universal soul which humanity has for so long sought and which now comes within its purview. Bergson's *Creative Evolution* sums up this effort on the part of humanity to evolve the world-soul. As interpreted by Le Roy, Bergson voices the ethical implications of this aspiration in the words: "In the depths of ourselves we find liberty, in the depths of universal being we find a demand for creation. Since evolution is creative, each of its moments works for the production of an undeducible and transcendent future. This future must not be regarded as a simple development of the present, a simple expression of germs already given. Consequently we have no authority for saying that there is forever only one order of life, one plane of action, only one rhythm of duration, only one perspective of existence.... Taking life in its first tendency, and in the general direction of its current, it is ascent, growth, upward effort, and a work of spiritualizing and emancipating creation; by that we might define Good, for Good is a path rather than a thing."

It is just this path which is represented by unified and harmonized human thought, but in order to take it humanity must be spiritualized, so joined as soul to soul, each a unit of good, the many completing the one, the one recruiting the many, that the irresistible force of all minds and wills shall be able to refashion the world and achieve even immortality itself.

But is not this setting all nature's laws at naught, a fantastic dream, a *reductio ad absurdum*? For proof to the contrary we must

turn to the experience of mankind, reenforced by the dicta of science itself. Is immortality impossible of achievement? The belief in life after death is fundamental in the human race. Professor Hyslop, in his recent book *Life After Death,* traces it from its beginning in savages, through the Greco-Roman and Christian epochs up to modern times. In the final analysis, the belief in after-life is the belief in man's immortality, for if man is possessed of an immortal principle, its operations cannot be confined to life after death but must be inclusive of all his existence. This should mean, it may be urged, that he lived before. He did, in an undifferentiated state, far antedating the evolution of his consciousness. Science tacitly admits it. Weismann and other biologists have established the immortality of the germ-plasm, showing that it is carried down from generation to generation, independently of the soma or body that grows up around it as its servant. From this viewpoint the vital principle is inherent in cell-structure, in organic molecules, even in matter itself. And all chemistry, as Mendeleyeff pointed out, may be reduced to the operation of the physical laws. In this connection the law of the conservation of energy has a direct bearing on immortality, for its operations cannot be restricted only to the conservation of physical energy, but must include also the conservation of man's psychic forces. It is absurd to think that the very culmination of the whole creative process—man's personality —should be doomed to disappear in a void. Professor Hyslop says:[6] "There is another argument of much force which the scientific mind will have to respect as long as he interprets the conservation of energy as implying the persistence of the antecedent in the consequent of the causal series which he studies.... You cannot say that the effect, consciousness, is a mode of action without assuming that the antecedent motion is also consciousness, or your conservation of energy does not hold good."

The import of this approximation toward a spiritual interpretation of the cosmos is apparent. Thus we can see that physical laws can be drawn upon in support of man's immortality. Nor does physiology offer insuperable obstacles to this view. The laws of chemistry are such that continued life is only a question of keeping up the equilibrium between the assimilation and dissipation of energy, between waste and repair. In this way the colloidal cell of the organism would be virtually immortal were it maintained

[6] *Life After Death,* pp. 171-72.

in a state of stable equilibrium. Disease and death are results of a breaking-up of this equilibrium: the colloidal cell loses its elasticity and its curve. Why should the maintenance of the curve be of such importance? Life is coming more and more to be regarded as nearly related to electricity, with the human organism viewed as a sort of storage battery. The flow of vital force is directly dependent on the structure which itself has fashioned. According to Dr. Spear (*The True Undulatory Theory of Sound*), the conchoid of sound-waves exactly corresponds to the conchoidal form of the ear, and even to the form of the vocal organs. The inference is plain: the organs were shaped by the sound-waves themselves.

Do we really set nature's laws at naught in reasoning thus about man's power to achieve immortality and to create his own world? Hear what Boutroux says at the close of his book on *The Contingency of the Laws of Nature*: "The laws of nature have no absolute existence; they simply express a given phase, a stage, a moral and esthetic degree of things, so to speak. They are the image, artificially obtained and determined, of a model that in essence is living and movable. The apparent constancy of these laws finds its reason in the stability inherent in the ideal itself.... In proportion as beings that cease to live solely for themselves and as the subordination of the lower being to the higher, the inner adaptation of the conditions to the conditions of matter and form, becomes more spontaneous and complete: in like proportion do we find a diminution throughout the world of uniformity, homogeneity and equality, i. e., of indisputable sway of physical fatality. The complete triumph of the good and the beautiful would do away with the laws of nature, strictly so called, and would replace them by the free flight of human wills toward perfection, by the untrammeled hierarchy of soul."

According to Boutroux, therefore, man is free, under the stimulus of the good and the beautiful (which is only one way of expressing the operation of the laws of unity and harmony manifest throughout the cosmos) to evolve his own laws. It should be clear. then, that "nature's laws" cannot be pleaded against man's attaining immortality in his present existence.

The manner in which man shall achieve immortality, whether by retaining his present organism, by means of advance in knowledge and science, or by divesting himself of his frame altogether

and evolving some other vehicle for his personality, more in accord with his higher spiritual nature, we may safely leave to the future and repeat with Bergson that we have no authority for saying that there is forever only one order of life, only one perspective of existence. Humanity's chief concern, moreover, lies in the realization that "the theory of knowledge and the theory of life are bound up with one another";[7] that "all philosophy is a soul, a mind, and begins with the simple unity of a generating intuition";[8] above all, that

> "All are needed by each one—
> Nothing is fair or good alone."

The process of cosmic unification manifesting itself through matter and in all forms of life, the human organism and man's racial and social development included, has reached a stage in which "the principle of good that is in the universe," as Paul Janet puts it, "must be not only conserver, but promoter, originator, creator." That is to say, the psychical powers of mankind—the thought and will of human beings—must unite in accordance with the laws of unity and harmony to bring about the evolution of the world-soul.

But is such a process feasible, and are there any reasonable grounds for believing it practicable? The first reason is that it is a spiritual process: it assumes spirit as fundamentally at work in the universe. For it is only in the light of the spiritual hypothesis that we can rationally comprehend the cosmos at all. All other hypotheses, whether materialistic or idealistic, leave no ultimate avenues for human thought: they swing us around a circle or land us inevitably in a cul-de-sac.

This process is in line with both science and logic. It assumes man beginning with matter not yet organic, and gradually rising through lower forms of life to be finally both conscious and self-conscious. In the nature of things man is unable to look back to his primordial state, but the power of consciousness which he has acquired confers upon him the vision of his goal—union with God. In achieving the goal, man will also encompass the beginning.

Also, progress toward the evolution of the world-soul is implied by the Biblical account of creation. According to the Scriptures, God, the Spirit, first created the elements, which He separated into land and sea; then He created different forms of life, beginning

[7] Le Roy, *op. cit.*, p. 115. [8] *Ibid.*, p. 139.

with the lowest and ending with human beings. Man was thus the final stage of the creative process. God created man in His image —perfect. God's perfect world was under the operation of the laws of unity and harmony. There was no strife in it; no death and no toil, that is to say, no struggle for existence. With the fall of man the original conditions were reversed (through the breaking of the laws of unity and harmony) and the world came under the sway of brute force with its concomitant, the struggle for existence. (In this connection, Professor Soddy offers a very pregnant speculation in his book on *Radium.*)

The greatest reason, however, for believing that a world-soul can be evolved is the spiritual incentive which it would offer to mankind. It is not the incentive of material gain at present actuating man, and not the incentive of emulation substituted for it by the social reformers, but only the spiritual incentive, with its goal of all-power and perfect freedom in immortality, which can transform the world. The instinctive longing for immortality, correlated with the horror of bodily dissolution, is deeply implanted in the human soul; there can possibly be no stronger incentive to moral perfection than the desire for immortality.

Nor is there anything in man's effort to achieve immortality that would controvert the teachings of religious belief. According to the Biblical account, man was created perfect, that is, invulnerable to death and disease. Through breaking the laws of unity and harmony, he lost his perfection and became mortal. By inference, as soon as he regains his perfection ("Be ye perfect"), he will reestablish the operation of the laws of unity and harmony, become immortal and evolve a perfect world.

For ages we have had the light of "Glad Tidings" to illumine our way, yet humanity still fails to grasp the full import of the Divine message!

The bodily resurrection of Christ, which constitutes the cornerstone of our Christian faith, furnishes a sublime example of the triumph of the Divine over merely physical laws, and if we are no less consistent in accepting the data of modern science than we are in believing the dogmas of Christianity, we shall inevitably regard the principle of man's immortality as being in agreement with both our Christian faith and with the postulates of modern science.

One advantage of the conception of a world-soul, as a spiritual

incentive to effort, lies in its intelligibility for the general mind and for humanity at large.

Professor Hyslop says:[9] "If philosophy is to have any legitimate function in the world, it must be convertible into the language of common life at some point of its meaning. No doubt, it has its esoteric aspects and that it cannot be understood as a whole by every one. But it is not a true philosophy unless it touches life in some general doctrine or belief."

Man's desire for immortality, apart from the instinct within him, has ethical implications that devolve upon him as a part of the existing order, which operates on the basis of brute force under the lash of the struggle for existence. All creation groans under it: war, pestilence, strife decimate mankind. The dumb animal world, with its untold agony and woe, is trampled underfoot. But the struggle for existence is merely a passing stage: the perfect world will know it not. Yet that world is not perfect in which the tiniest life is under stress. Collectively we are all responsible for the existing inequity. As society first produces the criminal, then punishes him, so every individual is responsible for the disasters that overtake mankind and for the aggregate misery of the world. Every individual soul of us is responsible for the solvency of our liabilities as spiritual beings, as a power for good.

Nor would humanity need in a perfect world to wrestle with the problem of evil which confronts it now. For that problem was fundamentally settled by the Scriptural edict which forbade man to taste of the fruit of the knowledge of good and evil. In the lower world of life the problem does not exist: guided by its instinct, the animal does only right, since instinct knows no wrong. To know no evil is not to do it. This principle underlies all education and training. St. Augustine gave a correct solution of the problem of evil when he negatived it by affirming that evil was "not doing good." The argument that all our knowledge is by antithesis, that we know the good only because of the existence of evil, is basically incorrect: evil subtracts from the knowledge of good, but does not add anything to it. In reality there is no antithesis. Science is explicit on this point. Below and above the spectrum accessible to human vision there are rays the eye cannot see; below and above the sounds we hear there are sound-vibrations which the ear cannot perceive. So the argument that all our knowledge is by antithesis

[9] *Op. cit.* p. 316.

has no validity. What is meant by antithesis is simply a lack of spiritual vision and sense. The values being transposed to the higher scale of existence, evil will automatically disappear from a perfect world.

Professor Hyslop writes: "Immortality has ethical implications when other theories of consciousness and its destiny have none. All theories either directly or indirectly favoring materialism or its equivalent, whether called idealism or not, do not satisfy ethical postulates in regard to the value placed upon personality or the ethical impulses in our very conceptions of morality, as it requires the future for the realization of its ideals. Man will always place ethics above everything else."[10] "All ethics are based upon hope and this because no action of the will whatever is rational without an end which always requires the future for realization of it, and we must be assured that the law of nature allows of that fulfilment. Hope is therefore as much a part of the cosmic scheme as is any interest in the past or the present. No science or philosophy is complete without taking it into account."[11]

Man will always place ethics above everything else because he instinctively feels that in his moral perfection and righteousness he has a path, the only path by which to reach God, and through God and in God, to achieve all power—to become divine. This is the meaning, we take it, of Bergson's intuition.

Like a caged squirrel, man for ages has been running round and round within the wheel of life. Has not the time finally come for him to realize himself as a free being, with all that freedom in the world-soul implies?

Ralph Waldo Emerson says in his divinity school address: "I look for the hour when that supreme beauty, which ravished the souls of those Eastern men, and chiefly of those Hebrews, and through their lips spoke oracles to all time, shall speak in the West also. The Hebrew and the Greek Scriptures contain immortal sentences that have been bread of life to millions. But they have no epical integrity; are fragmentary; are not shown in their order to the intellect. I look for the new Teacher that shall follow so far those shining laws, that he shall see them come full circle; shall see their rounding complete grace; shall see the world to be the mirror of the soul; shall see the identity of the law of gravitation

[10] *Op. cit.*, p. 324.

[11] *Ibid.*, p. 332.

with purity of heart; and shall show that the Ought, that Duty, is one thing with Science, with Beauty, and with Joy."

Prince Troubetskoy,[12] after pointing out the inadequacy of philosophy to solve the question of human destiny, sees man's salvation, as of yore, in the Saviour's Cross, with its lateral line representing earth and its vertical line pointing to heaven. In other words, humanity can reach its goal only in the light of a divine ideal which will supply a working guidance to man on the plane of his earthly existence.

What the world needs is a reinterpretation and spiritualization of all life and civilization. New values should be set on man's personal responsibility as a unit of good. Above all, our knowledge must become our life and at one with religion.

Humanity's most sacred duty, as the guardian of its own future, is to train and rear the new generations in accordance with this spiritual revaluation of man's place and end in the world. Thus far humanity has failed because it lacked clarified vision, spiritual insight and organization. If man is to be freed from the shackles that bind him, and all creation liberated from brute force, the spiritual incentive must sway all human minds until the world-soul becomes a reality. Then, and only then, shall we in truth become "coworkers with God."

Bergson says: "The true metaphysics will be an immediate vision of reality and the mystical experience is certainly that."[13]

Those to whom the spiritual experience was vouchsafed know that the Spirit liveth, for they felt its presence in the transcendental beatitude of the soul before which pale all earthly joys. Some writer has said that could all men but realize it, none would be left to live this life.

Were Nirvana to be the final solution of man's destiny, this world would vanish in a trice. It exists only in virtue of its goal and by the grace of man's redeeming faith.

"And I saw a new Heaven and a new earth."

L. L. PIMENOFF.

BOSTON, MASS.

[12] *Loc. cit.*

[13] Quoted by Macintosh in "Bergson and Religion," *Biblical World*, January, 1913.

LORD RAYLEIGH.

1842-1919.

The death of John William Strutt, third Baron Rayleigh, closes the roll of the Victorian mathematical physicists. Descended from a family that settled in Terling Place in the late years of the eighteenth century, his life was a serene and successful one. He had no obstacles or difficulties in the way of a career to overcome, but the family motto, *Tenax propositi*, finds fit expression in the tenacious, ordered effort of his life.

John William Strutt was born at Langford Green in Essex on the 12th of November, 1842, and went to Trinity, Cambridge, in 1861. He was Senior Wrangler, Smith's prizeman, and was elected Fellow of Trinity in 1866. The next landmark in his life was 1873, when he was chosen a Fellow of the Royal Society and succeeded to the barony. In 1879, when on the death of Clerk Maxwell the Chair of Experimental Physics fell vacant, he was elected to the position, which carried with it the directorship of the Cavendish laboratory, which he held for five years. Though busy with his own scientific pursuits, Lord Rayleigh set himself to develop its possibilities for students, and organized a system of invaluable practical teaching in experimental physics. The great increase in the popularity of the Natural Science Tripos at Cambridge is in no small measure due to his efforts. In 1884, he was President of the British Association, and in 1887 he succeeded Tyndall as Professor of Natural Philosophy at the Royal Institution, a position he held until he was made President of the Royal Society in 1905. A year later he became Chancellor of the University of Cambridge. His honors were many, and among them he received the Order of Merit, and the Nobel Prize for Physics. He died on the 30th of June, 1919.

Apart from his necessary activities as a landowner—he was a purveyor of milk to London and an enlightened agriculturist—he is chiefly known to the world as the discoverer of argon. That discovery does not exhaust the sum of his contributions to science, which may be measured by the five volumes of his collected papers (1869-1910), printed by the Cambridge University Press, and bearing the motto: "The works of the Lord are great, sought out by all that have pleasure therein." These papers—three hundred and forty-nine in all—fall into three main divisions, on sound, on optics,

and experiments to determine certain fundamental physical constants. Among these are scattered lighter efforts, *parerga* such as a paper on pinhole photography, on "Mr. Venn's Explanation of a Gambling Paradox," and "Insects and the Colours of Flowers" (Vol. I, pp. 336 and 222). In 1871 he published an important series of papers on optical questions, including the theory of the scattering of light by small particles, and its application to explain the blueness of the sky. He found time to determine, by means of exact and patient experiment, certain fundamental quantities in electric measurement, the value of the ohm, the electromotive force of the Clerk standard cell.

In his address to the mathematical and physical section of the British Association in 1882, he had affirmed his conviction that the time had come for the redetermination of the density of the principal gaseous elements, and said that he had already made some preparation for this work, which occupied him for more than a decade after he had left the Chair of Physics at Cambridge in 1884. Having obtained satisfactory values for oxygen and hydrogen, he turned to nitrogen, and discovered certain baffling discrepancies in a given volume of nitrogen extracted from the air, as compared with the same volume obtained by chemical means from nitrogen-containing compounds. He was led to the conclusion that nitrogen extracted from the atmosphere was contaminated with an unknown, inert, heavier element, which he named argon. This valuable and most widely known of his discoveries witnesses to his meticulous accuracy and perseverance. His scientific work never blazed into a single flare of notoriety; and though useful, it never reached a great commercial success. He was not a great inventor, but he increased the range of fog-horns. His work is characterized by finish, skill, competency, even elegance, *style*, in fact. Much of it was critical in essence, and consisted in the filling in of gaps or the removing of obstacles in other men's investigations, the labor of the file, the final process of polish to theories roughed out by others. He has been truly said to be rather a critic than a creator, and a man with a lesser share of scientific imagination than the two great Victorians, Kelvin and Maxwell.

BOOK REVIEWS AND NOTES.

MODERN SCIENCE AND MATERIALISM. By *Hugh Elliot*. London and New York: Longmans, Green and Co., 1919. Pp. 211. Price $3.00.

"The main purpose of the present work," the author says (pp. 137f), "is to defend the doctrine of materialism. It is, indeed, a materialism infinitely different from that of the ancients, for it makes vast concessions to agnosticism, and it concedes the whole foundation of knowledge to idealism. Yet it remains materialism; for I shall endeavor to show that the whole of the positive knowledge available to mankind can be embraced within the limits of a single materialistic system."

Taking the position that all true philosophy must be based on the facts of science, the author devotes the first three chapters to a résumé of the chief conclusions of astronomy, physico-chemistry and biology, under the headings "The Universe as a Whole," "Matter and Energy" and "Life and Consciousness." A chapter on "The Fallacy of Vitalism," largely concerned with physiological questions, ushers in the philosophic part of the book proper, one chapter on "Materialism" and one on "Idealism." The last two terms are not intended to designate two rival doctrines—in the author's words (p. 14), "the old antithesis between materialism and idealism vanishes completely....they are one and the same doctrine, looked at from different aspects and stated in dif ferent words."

On the whole, the author's philosophy may be described as an adaptation of the work of Ernst Mach, for while he tries to define his position over against that of Bertrand Russell and especially that of William James (p. 15), it is apparent that all his major theses are contained in the teachings of the great Viennese positivist. Needless to say that this detracts nothing from the value of the book—on the contrary, for Mach's views will be worth spreading for at least a hundred years to come.

If we have any fault to find with the volume before us, it concerns a gap rather than any positive statement, for we find nothing adequate said about the mind-brain relation. The third chapter deals with consciousness only in a few preliminary paragraphs, leading up to the assertion that certain "specific physico-chemical reactions of nerve tissue....actually *are* consciousness, in precisely the same way that the specific reactions of protoplasm actually *are* life" (p. 102). Similarly we read on page 122: "What *is* a state of consciousness? The untrained mind will, of course, immediately hypostatize it, and call it a *thing*. Let us, however, call it a process, and instead of regarding it as a

thin and shadowy accompaniment of certain cerebral processes, let us boldly identify it with those processes, and say that it is one and the same." For proof we are in both cases referred to the final chapter. Now we may be in complete accord with the author's theory, but having read his book from cover to cover we cannot see where he has proven it.

If we identify consciousness with certain cerebral processes, the fact remains that here are two aspects of one thing x—to be explored by psychology and the physiology of the nervous system respectively—whose mutual relations seem to be a subject of legitimate inquiry. It is precisely on this question that the author fails to enlighten his readers, the very problem on which the metaphysics which he condemns is thriving to this day. There is not a word in the book, e. g., about Richard Semon's theory of the *mneme*, particularly as applied to the nervous tissue, though on the other hand we find nothing in it, either, to bar the author from accepting this theory. As things are, his own views come dangerously near to inviting the charge of epiphenomenalism (cf. pp. 189f), for if no relation is established between consciousness and cerebral processes, and we can hardly doubt the objective quality of the latter, what else can consciousness be but their despised "accompaniment"?

A few words might be said about the author's polemics against "the confused idea of things existing 'in themselves' as apart from the way in which they appear to us" (p. 181). On page 4 we read: "If, then, all knowledge and all imagination is based on sense-impressions, it is clear that our notion of the universe is bound to remain forever of the most incomplete possible character. Supposing we had a few more senses, how very different everything would appear....To a being thus endowed, the philosophy of a mere human being must appear indeed primitive....Yet, though it would so vastly exceed ours, the intellect of even this being would be no nearer than *we* are to the ultimate mysteries of existence....," and so on and so forth. We must leave it to the author to reconcile these two statements; suffice it to say that Kant is *not* touched by his attack.

X. B. N.

THE INTUITIVE BASIS OF KNOWLEDGE. By *N. O. Lossky*. Translated from the Russian by *N. A. Duddington*. London: Macmillan & Co., Ltd., 1919. Pp. xxx, 420. Price, 16s. net.

This work of Professor Lossky falls into two parts: the first, a summary of the problem of knowledge in modern philosophy which is mainly critical, and an examination of the systems of pre-Kantian empiricism and rationalism as presented in the systems of Locke, Berkeley and Hume; the second, Professor Lossky's own solution. He finds the same defect in all the attempts to solve the epistemological problem, which is "the assumption that the knowing subject is isolated from the known object." If knowledge and the known object are isolated from each other, knowledge can only correspond to the known object in the sense that in knowledge a more or less perfect *copy* is found of the known object. But if knowledge is a copy of an original which is external to the process of knowing, experience certainly does not provide us with any criterion for determining the degree of correspondence between the copy and the original. "Indeed, in this case, there are no conclusive grounds for affirming such a correspondence" (p. 31). Consistently carried

out, empiricism, therefore, was compelled to drop the discussion of the question as to the relation of knowledge to the external world.

Professor Lossky has his own solution. Let us assume, he contends, that reality is immanent in the knowing process, that "knowledge is neither a copy nor a symbol nor a phenomenal appearance of the real world in the knowing subject, but is reality itself" and all difficulties are disposed of. It does not, however, dispose of intuitions of error. Professor Lossky tells us that error is the failure to differentiate between the object as given and the fallacious subjective element of our own thought. Who is to separate the two elements? Professor Lossky's recommendation of "reiterated differentiations guided by the consciousness of objectivity" is not satisfactory.

He insists that a theory of knowledge is not called upon to take its stand upon a specific metaphysical conception of the world, but should be regarded as a branch of philosophical investigation which is preliminary both to metaphysics and to those departments of philosophy which have to do with the more concrete aspects of experience (p. viii). But it is not easy to keep strictly within the limits thus set, and Professor Lossky occasionally allows glimpses of his own attitude. For example, in the last chapter, after having urged that there is no antithesis between the universal and the individual, that the true universal is in fact what may be called "concrete universal," he proceeds to give his assent to the doctrine that a complete unity of the world is intelligible only if the world be thought of as grounded in an Absolute Reason, wherein all its aspects are coordinated and teleologically related to one another (p. 412). Professor Lossky's book, which is ably introduced by Professor Dawes Hicks, has distinct merits, lucid statement, vigorous and colored illustration, a wide philosophic knowledge; and not the least of the attractions to the English reader is the translation by Mrs. Duddington from a copy of the text specially revised by the author. M. J.

RECONCILIATION AND REALITY. By *W. Fearon Halliday, M.A.* (The Christian Revolution Series, Vol. 2.) London: Headley Bros., Ltd., 1919. Pp. 234. Price, 5s. net.

The editor of the Christian Revolution Series says in a general foreword that "these books are written under the persuasion that only a religious solution is adequate to the world's need, and that only upon the principles for which Jesus of Nazareth stands in history can the world be fashioned to heart's desire."

Mr. Halliday's contribution is not revolutionary. The beliefs which he expounds are intensely personal, but they are dressed out by modern science and medieval logic. Again and again the author brings his beliefs to the test of experience. His implication is "if we do not believe this or that, then we shall be unhappy; if we do believe this or that, then we have an explanation and a harmony." For instance, he says about nature: "It is difficult to think that God interferes with this order from without. If He does we are involved in endless difficulties as to why He does not interfere in a different manner." This type of argument is characteristic and is not valid except for pragmatists. Within these limits the book will be of value to those who are prepared to accept the premises.

The author is afraid that his book may be exposed to the charge of being mere theorizing. But theory creates the atmosphere in which conduct operates. The difficulty is to compromise the issues raised by thought and experience. We prefer Mr. Halliday's ethics to his theology: when he attempts to combine them, one or the other suffers. The following is an example, chosen because it goes to the root of the subject of this book: "Reverently let it be said, for Jesus to have failed to take the way of the Cross would be to have shown, that He was not righteous." Many people will feel that, however reverently the foregoing is said, the plain fact is that Jesus Christ was crucified because His contemporaries did not understand His teaching and therefore would not tolerate it. But Mr. Halliday's statement by a curious contortion throws the responsibility for a piece of human folly and persecution not on the authors but on the victim. It may be sound theology to do so, but is it sound ethics?

A. E. FELKIN.

LONDON, ENGLAND.

OLD TESTAMENT PROPHETS. By *W. A. C. Allen*. Cambridge: W. Heffer and Sons, Ltd., 1919. Pp. 195. Price, 6s. net.

Mr. Allen's work is a fresh and well-balanced popular sketch of the prophets, seen against their historic background. It belongs to a class of sensitive, well-written books, in which no claim is made to original research, and which is yet fully in touch with the results of original research. In spite of the small compass of the book, its range is a wide one, the first chapter dealing with the story of ancient Israel from Abraham to the setting-up of the monarchy, the third with its subsequent history under the kings, while intervening, is a chapter on Oriental religions. Chapters V onward are concerned with the personalities of the greater prophets.

Following, as Mr. Allen does, the footsteps of those who have devoted a life-work to the investigation of the problems presented, there is little to criticize except from a purely literary point of view (pp. 45-46, in which the "essentially prosaic English" is contrasted with the Hindu). His point of view is conservative yet sympathetic, and he admits that "as all experiences which human nature undergoes are real, so all religions must be to a certain extent true. We cannot admit that there is any form of faith which is altogether false" (p. 190). That does not amount to saying that he is always on the safer side in his assumptions, as witness, for example, his argument in favor of the historical existence of Abraham. J.

THE CAUSES AND COURSE OF ORGANIC EVOLUTION: A Study in Bioenergics. By *J. M. Macfarlane, D. Sc.* New York: The Macmillan Co., 1918. Pp. ix, 875. Price, 17s. net.

This very comprehensive—even encyclopedic—book deals on a grandiose scale with the evolutionary problem, beginning *ab ovo*, or indeed even earlier, as Professor Macfarlane starts from ether and energy in the evolution of matter, the relation of inorganic to organic bodies, and advances slowly by way of plants, and the lower and higher animals, to man (Chapters I to XIX).

The remaining chapters deal with man in various aspects, and three chapters are given up to religion as a formative factor.

Professor Macfarlane does not hold the view that religion and science occupy spheres and pursue methods that are largely opposed to each other; he believes that God is the great ultimate energizing unity of the universe, which may be discovered by man, just as the laws of nature are discovered; while he regards Christ as "one and only one of those great human prophets or proenvironers who have successively appeared during the past ten to twenty millennia." A word is necessary here as to the "Law of Proenvironment," an unfamiliar phrase (Chapter IX), defined by Professor Macfarlane as "the capacity of an organism for perceiving and then positively growing or moving toward an environment that is most satisfying to it," which appears to owe its origin to his taste for innovations in scientific phraseology. As may be seen, Professor Macfarlane presses science and religion, sociology and ethics into this massive contribution to the evolutionary problem, and his subject matter "slips from politics to puns, from Mahomet to Moses," like Praed's vicar.

The book may be read with interest in spite of its occasionally cumbrous phraseology, which, for instance, does not shrink from describing Christ and His followers as having "reached the highest stage of proenvironal aspiration in the religion of Patritheism" (p. 749). M. J.

BOOKS RECEIVED.

Westaway, F. W. Scientific Method: Its Philosophy and Practice. (New edition.) Glasgow and Bombay: Blackie & Son, Ltd., 1919. Pp. xxiv, 426.

Harris, Rendel. The Origin of the Doctrine of the Trinity. Manchester: The University Press, 1919. Pp. 41. Price, 2s. 6d. net.

Galloway, G. The Idea of Immortality: Its Development and Value. Edinburgh: T. & T. Clark, 1919. Pp. viii, 234. Price, 9s. net.

Mills, J. The Realities of Modern Science: An Introduction for the General Reader. London: Macmillan & Co., 1919. Pp. xi, 327. Price, 10s. 6d. net.

Carpenter, Edward. Pagan and Christian Creeds. London: G. Allen & Unwin, Ltd., 1920. Pp. 318. Price, 10s. 6d. net.

Problems of Science and Philosophy; the papers read at the joint session of the Aristotelian Society, the British Psychological Society and the Mind Association. London: Williams & Norgate, 1919. Pp. 220. Price, 12s. 6d. net.

Freud, S. Totem and Taboo; Resemblances Between the Psychic Lives of Savages and Neurotics. Translated by A. A. Bull. London: G. Routledge & Sons, Ltd., 1919. Pp. 268. Price, 10s. 6d. net.